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and
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The Outlook

Japanese Bombers and Fighters

SO far as can be judged from the official communiqués, Japanese bombing is not distinguished by great accuracy of aim. No doubt when the same bombers were raiding flimsy Chinese cities it did not matter very much where the bombs fell, and then there was little inducement to strive after precision and pinpointing. So the bomb-aimers lack experience.

Japanese fighters, on the other hand, whose experience cannot have been much more instructive (though many Chinese do take readily to the air), have met with some surprising successes in their encounters with British and Australian pilots. On a number of occasions lately the losses on each side have been roughly equal, and so far there has been no case in which our Buffaloes, or whatever other fighters we could then raise, have shot down Japanese fighters on anything like the scale to which we have become accustomed when meeting Germans or Italians in Europe or the Middle East. In a recent raid on Singapore, for example, when about 50 heavy Japanese bombers came over with a fighter escort, the enemy lost 13 machines, but nine of them fell to the A.A. guns and only four to our fighters. Again, in one raid on the island of Rabaul (which is an Australian Mandate) three Japanese machines fell to the fire of the A.A. guns, while the Australians lost five aircraft. There have been other similar cases.

Everybody knows that the Japanese are a fanatically brave people, but Britons from the Far East have not reported that they very often make good air pilots. When brave but not highly skilled fighters meet British fighters from any part of the Empire, the usual result is a holocaust of the enemy. A likely explanation might be that hitherto the Japanese have enjoyed great superiority in numbers—but the Germans often enjoyed the same advantage in the Battle of Britain. So the mystery remains. However, Hurricanes have now appeared on the Malayan front, and as soon as they got into action the enemy losses began to increase.

Parallel Grooves

THE debate in the House of Lords on January 20th was very interesting. In particular one noted how the minds of Service peers, even the most eminent, tend to work in channels. Admiral Lord Cork said that the cause of our disasters in the Far East was our loss of the command of the seas in that area. Lord Trenchard said that our continued withdrawals in Malaya were in large measure due to lack of local air superiority. The two statements are not contradictory; they are both correct up to a point, each in its own way, but the working of the two minds is instructive. The moral may be drawn that the more we think about winning the war by the combined efforts of all three Services, and the less we pin our faith to one particular arm, the wiser we shall be.

Lord Trenchard, in his weighty speech, insisted that the true defence of airfields was the responsibility of the short-range fighter. By day that is unquestionably true, but the former Chief of the Air Staff did not discuss the case of an air-borne invasion on a moonlight night. He may have reasons for confidence that even in such conditions fighters could defeat the attempt, but to the layman it seemed that the issue would at least be doubt-

ful; and if the fighters were by-passed in the partial darkness, then would come the fight on the ground.

It was more than a little surprising to find Lord Trenchard putting the case of Crete in the same class with Greece and Malaya. In Crete, if we could have prevented the enemy from using Maleme airfield by keeping it under artillery fire, we might have held the island. Stukas defeated the efforts of our gunners. Fighters were wanted to deal with the Stukas. In that case control of the airfield meant possession of the whole area. In the other cases control of the area meant possession of the airfields.

In Crete we might have saved the situation if we had had enough fighters on the spot. In the other cases it is not at all so clear that air superiority on our side would have driven back the invaders. Air superiority, like sea superiority or land superiority, does not always by itself mean victory. In Libya, for instance, we have air superiority and have used it magnificently, but the R.A.F. cannot overwhelm Rommel's heavy tanks without cannon of suitable calibre.

Divided Unified Command

SIR ARCHIBALD SINCLAIR tried to explain to the House of Commons on January 22nd how the Royal Air Force Regiment would obviate divided command, but it was clear from the debate which followed that the House was not completely satisfied. He admitted that there had been friction in the past, and that sometimes air stations had been defended by soldiers, for which the station commander had no responsibility, and sometimes by airmen, for whom the local Army commander had no responsibility. The new scheme ought at least to get rid of that sort of thing. The Air Minister ended his speech with a sort of appeal for goodwill on both sides, and such an appeal is a confession that a scheme is not ideal.

The ground defence of air stations remains a responsibility of the Army, but the local contingents of the R.A.F. Regiment could not, said Sir Archibald, be "whisked away" to take part in a battle some distance off. But Mr. Attlee in his earlier speech on the subject had said that if a battle took place near the station, the station commander would, for the purpose of defence, come under the control of the local military commander. Sir Archibald sprang a surprise when he added to this that at some time (apparently at the discretion of the A.O.C.-in-C., Fighter Command) the control of the anti-aircraft guns would be handed over to the local Army commander. So there will have to be divided responsibility after all, and there seem possibilities of friction about the moment when the change-over of command must take place.

The members who criticised the scheme had no better suggestions to make, and, indeed, it is difficult to devise a perfect scheme. Any conceivable plan must involve some measure of dual control, and the only thing to do is to minimise that so far as possible.

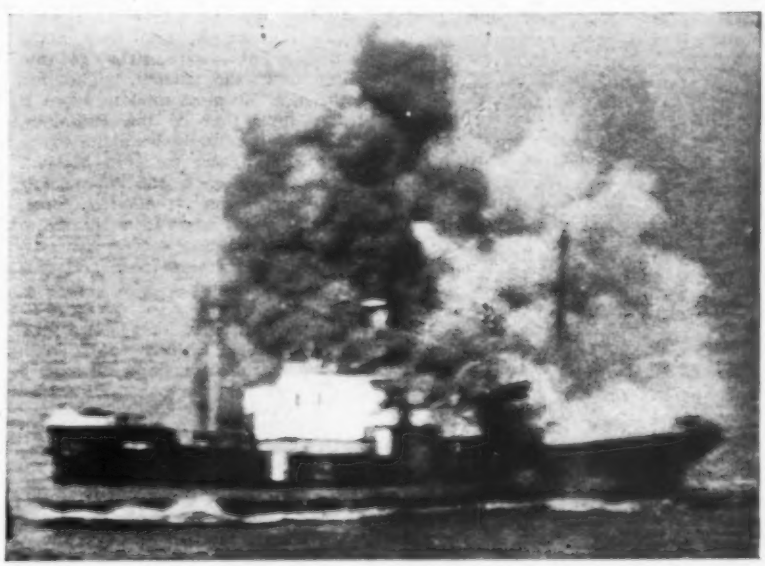
FOR BIG, BEAUTIFUL BOMBS: Production lines in one of the many British factories which build Stirling bombers. The openings in the wing surfaces are to receive the fuel tanks. An illustrated article on the Short Stirling appears on pp. 94-101.

Wrecked Axis aircraft at Derna airfield during the Battle of Libya.

R.A.F. Offensive in Malaya : Bad Weather in Libya : U.S. Bombers Sink Japanese Cruiser : New Guinea Heavily Attacked

ONE hopes that it was a true report which a Japanese airman brought in from a reconnaissance that he had seen three 30,000-ton battleships in the Strait of Malacca, but for the present we can expect no definite news of naval movements in the Far East. The Japanese are sailing freely about the western side of that ocean, landing troops at their will on the Bay of Bengal side of Malaya and in the Philippines, besides despatching carriers to New Guinea. Such freedom can only be based on a battle fleet in a good position to attack any Allied warships which may try to hamper the movements of lesser craft. But the absolute silence of all the Admiralties on both sides is in itself an indication that naval movements are going on. The Japanese are the poorer by the loss of a cruiser which has been sunk by Fortresses of the American army off the Philippines, another score to the bomb, which has not had many successes against warships in this war.

More air squadrons have reached the defenders of Malaya, and a vigorous air offensive against the Japanese has begun. Many of the airfields which they have seized and are using have been raided, and some, at any rate, of their aircraft have been put out of action. One correspondent from that front has been urging that now it is of less consequence to raid the Japanese airfields than to attack the troops which have been concentrating for a mighty assault which will, they hope, carry them up to and into Singapore island. It must be a nice point to decide which set of targets ought to receive priority, and it is not clear who must decide. General Pownall, who was C.-in-C., Far East, has now presumably taken up his new appointment as General Wavell's Chief of Staff in Java, and without direct orders from that headquarters (which presumably is not intended to make tactical decisions) it is hard to guess whether the G.O.C. or the A.O.C. in



PHUNG! : R.A.F. Mediterranean Command score a direct hit on an Italian transport.

FAR EAST AGGRESSORS : Mitsubishi 96 twin-engined bombers in formation.

Singapore has the final say. Some Air Officers may feel a natural inclination to go for the airfields first (on the principle that birds of a feather flock together), while the General knows that both targets are of importance when a big battle is imminent. But at least there is no conflict of opinion between strategic bombing of production and tactical bombing. Both targets in this case concern the coming battle, and the only question is which policy will help our troops most in that battle.

Some of the barges and other craft which the Japanese have been using to land troops near the mouths of small rivers have been bombed and shot up by our aircraft, and that is certainly good work and shows that the A.O.C. is willing to leave airfields alone at times in favour of enemy reinforcements. But the enemy aircraft are none the less important, and must be thinned out.

The anti-aircraft gunners in Malaya deserve more than a word of praise. Presumably most of them have not had much previous practice at real live targets, but they have in a very short time shot down a highly respectable number of enemy bombers, having, in fact, done better than the local Empire fighters in that respect. But it is known that more fighters are arriving in Singapore, and they may soon weigh down the balance in favour of their own method of attack.

Among the new arrivals are some 12-gun Hurricanes, and they made themselves felt as soon as they got into action with the enemy. The fire power of these most modern types is greater than that of the Buffaloes, which had previously been the mainstay of the fighter force in Malaya. The latter are good and their pilots like them, but the Hurricane, especially in its latest form, is one of the two outstanding successes of the air side of the present war, and it is not to be expected that Japanese fighters will be able to stand up to it.

The population of Malaya is a mixture of Malays, Chinese, and Tamil Indians from Madras, and all have a healthy dislike for the Japanese,

QUICK WORKER: An R.A.F. corporal who, in a sandstorm, suddenly found himself within 15 yards of a group of Germans in Libya. He shot a German officer with his revolver and then brought his lorry and two hundred gallons of water safely home.

which recent events have done nothing to modify. One Chinese restaurateur has promised to present a bottle of champagne to every pilot who shoots down an enemy aircraft. If he had been in England during the Battle of Britain he would have been ruined.

The Dutch have been following the "scorched earth" policy in their East Indian islands, and the second most important oil centre in Borneo, Balik Papan, has been destroyed. It is well that the Japanese should not be able to get oil from this centre, but it is deplorable that it should have to be destroyed. The Allies have relied largely on the Netherlands East Indies for their oil supplies, and the destruction of this particular source of supply is not a light loss.

Malta Hitting Out

MALTA has been raided almost incessantly for a long time past, but she is not taking the infliction lying down. Matters have more or less resolved themselves into a duel between Malta and Sicily, and in the Italian island the most important air base is Catania. So, on the night of Monday last week that base was subjected to no less than ten hours of continuous bombing, doubtless by Wellingtons. Of course, it was not by a long way the first raid made on the place, but it was by far the heaviest up to date. The destruction wrought was widespread, and it is believed that a respectable number of German bombers was destroyed. Not long before dawn, just before one of our later formations arrived, the men on the ground must have thought that all was clear, and the landing lights were switched on to allow two Ju 88 bombers to come home. But one of our machines came over at the same time, and probably the sound of its engines mingled with that of the German machines. Just as one Junkers was about to touch down, the British bomb-aimer let go a stick on the runway, and the Junkers ran into one of the exploding bombs. Neither that machine nor its crew will worry Malta any more. Other enemy machines were set on fire on the ground. Their crews would not be in them, but in such a heavy raid it is not to be expected that all the men on the ground would come through safely. Some of the ground staff, too, were probably killed, and they are almost as valuable as the air crews.

By day the Sicilian airfield at Comiso has been raided, while Heraklion, in Crete, and the submarine base at Salamis have also received attention. Hurricane bombers made the daylight raid on Comiso, in the south of the island, and the pilots saw the aircraft clearly on the ground. They set a lot of them on fire, but, naturally, did not stay long enough to make a careful calculation of the damage.

E AIR

ENEMY AIR LOSSES TO JAN. 24th.

	Over G.B.	Over Continent	Middle East	Far East
Jan. 18	0	0	0	4
" 19	1	0	1	11
" 20	0	0	0	9
" 21	1	1	0	13
" 22	0	0	4	6
" 23	0	0	0	22
" 24	0	0	4	10
	2	1	9	75

Totals: North, 5,618; Middle East, over 3,445; Far East, 105.

The publication of the news that Mr. Churchill went to America in the new battleship *Duke of York* carries implications with it. The Prime Minister is the last man to use a battleship for his convenience if it were needed for serious work elsewhere, and the suggestion is that other capital ships are available for use in the Pacific to replace the *Prince of Wales* and *Repulse*. Naturally they cannot arrive there with the speed of a Boeing bomber, but we may hope for some stirring news before long. We think it may also be taken for granted that our Far East Fleet will not again sally forth without sufficient air protection. H.M.S. *Illustrious* was in an American Pacific port not so long ago, and was commissioned with Lord Louis Mountbatten as her Captain. Perhaps we may soon hear something about her.

Two Attacks on Axis Convoys

RECENT news tells of two notable attacks by air and sea forces on Axis convoys, both of them big and important convoys. One action took place in the Strait of Macassar between Borneo and Celebes, and raged for two days. Dutch and American aircraft both took part in it, and American naval forces joined in. It is highly satisfactory to see the U.S. Navy in action after hearing nothing about it for so long. At least three Japanese ships were sunk, four probably sunk, and 12 (including a destroyer hit by a bomb) damaged. The eight ships bombed in the first part of the action were all left burning. In addition five Japanese fighters were shot down by Fortresses and two more by Dutch aircraft, while a further two fell to ground fire. The Japanese freedom to sail where and when they liked in the Pacific is evidently being vigorously disputed at last.

BRITISH AIR LOSSES TO JAN. 24th.

	Over G.B. A'crft.	Over Continent B'brs.	Over Continent Ftrs.	Middle East A'crft.	Far East A'crft.
Jan. 18	0	0	0	0	1 (P'lt safe)
" 19	0	0	0	1	5
" 20	0	4	0	1	7 (2 p'lts safe
" 21	0	6	0	0	0
" 22	0	3	0	1	0
" 23	0	0	0	2	3
" 24	0	0	0	3	0
	0	13	0	8	16

Totals: North, 3,182; Middle East, about 908; Far East, 16.

RUSSIA'S LATEST: New photographs have arrived of the Russian twin-engined bomber which is known as the P.E.2. It is shown here taking off from a snow-covered airfield. Flaps are lowered about 30 degrees.

The other convoy fight was in the Central Mediterranean south of the Ionian Sea. It was such an important convoy that its escort consisted of a battleship, four cruisers and 15 destroyers, and one of the ships convoyed was a big liner of 20,000 tons, probably carrying troops as well as war equipment for Rommel. The first attack, on January 23rd, was made by R.A.F. bombers and torpedo-aircraft, and it may be noted that this is the first mention of the R.A.F. Middle East having torpedo-aircraft (Beauforts, no doubt) at its command. Hitherto the air torpedo has been in the Mediterranean the speciality of naval aircraft, some of which work from shore bases. The first attack was made on the battleship, doubtless an Italian vessel, but she took evasive action, and it does not seem certain that any of the bombs found their mark. When night fell, naval T.S.R.s took up the attack, concentrating their attention on the big liner. They certainly got home with one torpedo at least on the liner, while another hit the stern of a destroyer. Then the R.A.F. came on again and did more damage, and then naval aircraft once more. It is thought that one of the cruisers was hit by a bomb, while the big liner was heavily damaged. Next morning the convoy was seen steaming slowly eastward (which was not the direction that would take it to Tripoli) and there was no sign of the big liner. To say that she was "probably" sunk seems a very cautious way of putting things.

In Cyrenaica, Rommel has been reinforced and is trying to hit back in an eastward direction. Evidently it has proved impossible for the R.A.F. to prevent reinforcements and supplies from reaching him, despite the strenuous efforts of our squadrons

MERLIN ENGINES IN U.S.A.

Two-piece Cylinder Block Adopted

SPECIMENS of the Rolls-Royce Merlin engine now in large scale production at the Packard works in America have reached this country and are highly appraised. It will be remembered that a contract was placed for 9,000 engines, two-thirds of which are for British aircraft and one-third for the U.S. Air Corps. The engine under construction is the Merlin type XX 27-litre engine and is of similar design to the British equivalent in production in various factories in this country with one important additional feature, i.e., the cylinder heads are detachable and known as the two-piece cylinder block. This form of construction had been proved satisfactory by the Rolls-Royce Company and would have been adopted by them some two years or more ago had it not been for the fact that to introduce an important modification of this type would have delayed the attainment of maximum production. As however the Packard Company were, so to speak, starting *de novo* on Merlin production, the Rolls-Royce Company decided that it would be better for them to adopt this modified form of cylinder design. Resident engineers from Rolls-Royce works in England have been collaborating with the Packard factory from the outset.

LUFTWAFFE, QUO VADIS?

The Strain of the Russian Campaign : The Present Disposition : Possible Future Developments

By V. L. G.

THE sudden slackening of the operations of the *Luftwaffe* on the Eastern front is as unexpected as it is mystifying to many observers.

It has hitherto been a constant feature of German military operations to give their armies as much air support as possible. At a juncture, when the invaders are falling back under the pressure of the Soviet forces, this support is lacking. Such a departure from accustomed tactics must surely be occasioned by some weighty factors.

It appears, in fact, that it is "General Winter" who—although reputed to be out of date—contributed in no small measure towards paralysing the German air forces on the Russian front.

The *Luftwaffe* was no more prepared than the army for a campaign against Russia protracted through the severe winter months. German aircraft, operating from hastily prepared advance airfields, find ice and snow hard to defeat. The lack of snow-ploughs and the shortage of aircraft equipped with ski-undercarriages make operations from snow and ice-covered landing fields with bad subsurfaces an extremely difficult, if not impossible, task.

Another obstacle is the freezing-up of engines. Experience in the Finnish war shows that, in the extremely low temperatures of the Russian winter, the anti-freeze devices were but a poor help. Engines had to be kept running at intervals throughout the night to be ready to fly in the early morning hours. The shortage of suitable hangar facilities, storage and heating must, therefore, substantially reduce the operational capacity of the *Luftwaffe*, already handicapped by the transport difficulties of the surface supplies.

Reduced Air Support

While the German armies are continuing to retreat, the share of its air arm in the operations has thus been considerably reduced. To-day only one-third of the German air strength is operating on the Russian front. The reason for this, however, may be ascribed not exclusively to the operations of "General Winter" but to a new set of grand-strategy blueprints drawn up for the next phase of operations, for which the enemy is reputed to be gathering strength.

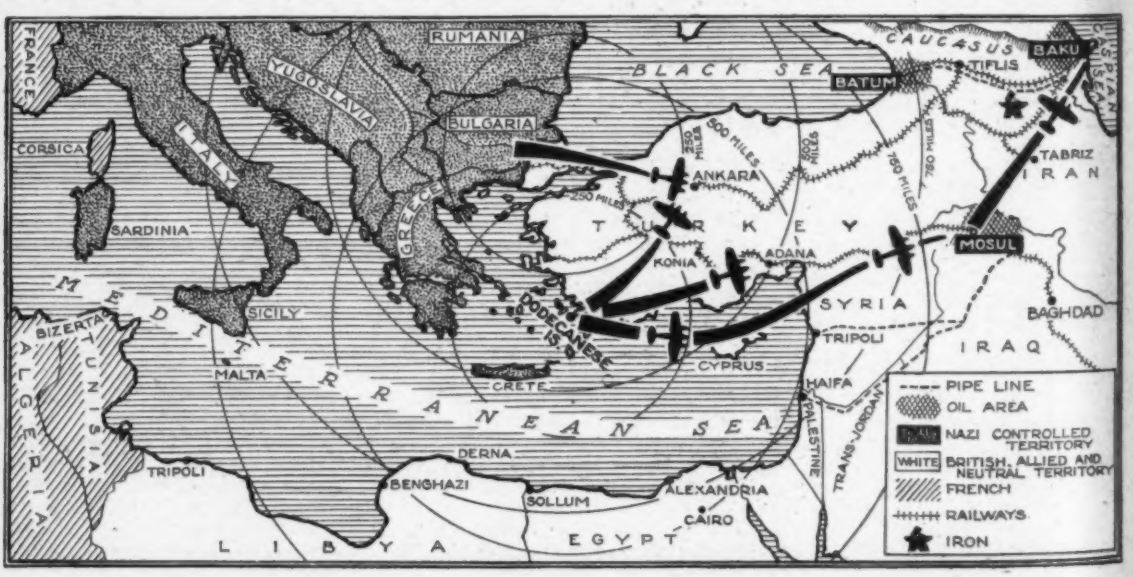
About one-fifth of the Nazi air forces is absorbed in the task of guarding Germany's western approaches against the R.A.F. and held in readiness for operations against this country. Another portion of the *Luftwaffe* had to be sent back home to lick the wounds sustained on the Russian front. A substantial number of operational aircraft has been sent back to occupied Poland and further inland for reconditioning, alterations in equipment, and fitting with new engines. The balance, together with such machines as are being continually reconditioned, is being distributed in new zones of the war theatre.

The Next Move ?

Where the new phase of German operations is going to open is still a secret of their High Command. It appears doubtful, however, whether the Germans will attempt another frontal assault against Russia. Their tremendous losses of men and material, their complete failure in political warfare with which they calculated to undermine Russian resistance, have no doubt had their effect.

It is more likely that Germany will endeavour to extricate herself from the Russian debacle by taking a new line of offensive elsewhere, in order to by-pass the main Russian lines of resistance and to replenish her oil reserves. Such offensive, the prelude to which may start even before the spring, might conceivably develop from the Balkans and Greece towards the Middle East.

There are already certain indications from which it is possible to deduce which course this new drive is likely to take: an oil pipe-line is known to have been constructed by the Germans and brought right up to the Bulgarian-Turkish frontier. Concentration of the *Luftwaffe* in Bulgaria and the Dodecanese might suggest that the northern arm of the German offensive is aimed at smashing its way through Turkey. At the same time the Germans may attempt to support their drive by hammering their way



through Syria towards the vital oil resources of Mosul. Since the fuel supply forms a vital necessity for any future major operations, it is quite likely that the latter course will be considered easier than a frontal attack across the Black Sea and the Caucasus, where their ground forces would not be able to make full use of their mechanised equipment. Moreover, the drive against Syria would be necessary to check any active British support to the Turks.

From the concentration of enemy units in Italy and from the recent continuous raids on Malta, it is evident that the Germans have not abandoned their idea of a southern arm of the vast pincers with which to crush the Middle East. Operating from Italy, Crete and Greece, the *Luftwaffe* may attempt to challenge British air supremacy in this sector and to prevent the consolidation of British forces along the southern Mediterranean seaboard.

W.A.A.F. ABROAD

Selected Personnel of the Women's Auxiliary Air Force Posted to the Middle East

SO satisfactory has been the employment of W.A.A.F. personnel for special duties in this country that a number of selected women are now serving in various stations of the Middle East Command. For the time being only officers are being sent overseas, chiefly for code and cipher work. Service abroad is voluntary.

The photographs below show them on parade in their tropical kit—making notes at a lecture—and taking a lesson on deportment from a shoebill in the Cairo Zoo. The one on the left shows the W.A.A.F. can be very decorative.

HERE AND THERE

Where Is He?

SINCE Cornelius Francis O'Sullivan left the Royal Air Force some years ago, trace of his has been lost. This has prevented the Air Ministry from paying various sums which are due to him. Any friend of his is asked to send his present address or to advise him to communicate personally with the Air Ministry (Accounts 13), Whittington Road, Worcester, or with his mother at 1, Coburg Street, Cork, Ireland.

Mr. O'Sullivan may be assured that it is to his advantage to take this action.

From "Nit" to "Tokarnia"

IN order to translate the above subheading into English you would need the *Anglo-Polish Translation of Workshop Terms* compiled by W. Bastyr and E. Paszkowski for the Association of Polish Engineers in Great Britain.

It contains 36 pages of engineering terms covering an extremely wide range of tools and workshop equipment generally, every single one of which is clearly illustrated, and it should be of enormous help to Polish technicians working in this country, not to mention their British workmates. In fact, it covers almost everything from a rivet (nit) to a lathe (tokarnia).

Canadians in the R.A.F.

AIR COMMODORE L. F. STEVENSON, soon to take over the Western Air Command after commanding Canadian air units in the United Kingdom, recently said he was convinced that airmen going overseas from the Dominion should be pooled with the Royal Air Force rather than be posted to purely Canadian formations.

He told a Press conference he realised the Government policy was to build up Canadian squadrons overseas, but he believed that "mixed teams" in the R.A.F. had been "a good job" and should be continued. This, however, was only his personal opinion.

Mr. L. P. Coombes, who gained the D.F.C. as a pilot in the last war, has been appointed adviser to the Australian Government on aircraft production.

BALING OUT: Heavy rains and floods in the Libyan desert have introduced the R.A.F. to "baling out" on the ground. This picture gives a good idea of the difficulties of keeping one's bed properly aired.

Japanese Straws in the Wind

ON November 14th last the Japanese Cabinet approved a number of Bills for submission to the special session of the Diet sitting the next day. Among these Bills was one for revising the air defence law and one for approval of a revision of the military service law, and within 24 hours the Nippon Government announced the establishment of a universal conscription service.

These facts were published in the *Foreign Commerce Weekly* issued by the U.S. Department of Commerce on December 6th.

And the following day, Sunday, December 7th, came the attack on Pearl Harbour!

U.S. Aircraft Output

ALTHOUGH actual production figures are now subject to rigid censorship, reports quoted by *Aero Digest* for last month indicate that between 2,150 and 2,200 aircraft "rolled off American assembly lines in October," and J. Buell Snyder, chairman of the House Military Appropriations Committee, is quoted as saying that he believed this rate would have increased to close on 3,000 a month by January.

It is also stated that the Consolidated production programme for 1942 provides that, by the middle of the year, they will be delivering every ten working days, as many aircraft as they produced in the first ten years of the company's history.

Lower Rate of Loss

SIR ARCHIBALD SINCLAIR, Secretary of State for Air, gave us welcome news when he announced recently that loss rate among our bombers attacking enemy targets at night showed a definite decrease.

He said that during the three months October, November and December, 1941, the proportion of casualties among our night-raiding bombers—both from enemy action alone and from all causes, including enemy action—was lower than in any of the five previous months.

Save Those Wrappers

READERS who receive their copies of *Flight* by post may be tempted, in their very natural eagerness to get at the world's best aviation journal, to tear off the wrapper and forget all about it.

But even the smallest scraps of paper are valuable these days, so they should spare a moment, before settling down to read, in order to add the wrapper, while it is still clean, to the household salvage collection; they can then enjoy *Flight* with a clear conscience.

"Flight" Index Now Ready

FLIGHT index for July-December, 1941, is now available. This may be had for 6d. (by post 7½d.), or together with a binding case for 4s. (by post 4s. 6d.).

If readers wish, however, their copies of *Flight* can be bound for them in the publisher's case at a cost of 10s., plus 9d. postage to cover the return of the completed volume.

Twenty-third of the Second Series

FRIEND or FOE?

Two Very Similar Floatplanes : Fokker T8W and He 115

FOKKER : High set tailplane with V struts, rounded tips and slight leading-edge backsweep. Straight-edged taper to fin and rudder with small round apex.

THIS week's selected pair, the Fokker T8W and the Heinkel He 115, are very similar aircraft in general appearance and happen to be types which are not so commonly encountered as many others. For these two reasons the likelihood of confusion is all the greater. But if one or two small but clearly distinguishable differences in their tail units are memorised, it should be comparatively easy to identify them.

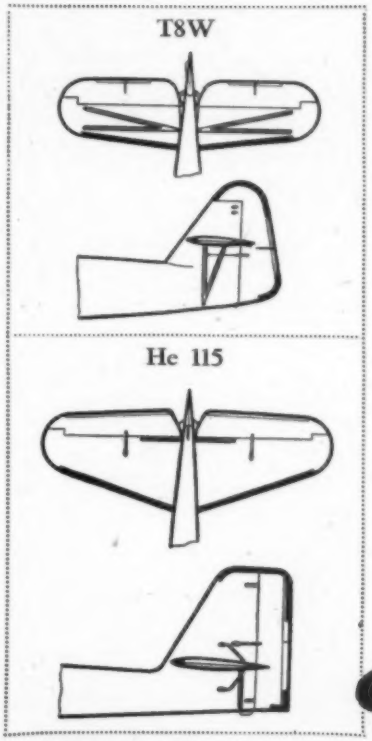
Our Dutch allies operate a number of Fokker float-planes, while the Germans still venture forth in the North Sea area now and then in the Heinkel He 115; two examples of this floatplane were encountered and "shot up" by a patrolling Liberator quite recently, in fact.

The most obvious difference in their respective tail groups lies in the vertical surfaces. In plan, their tailplanes are approximately of the same type and will need closer scrutiny in order to differentiate between them.

Speaking in general terms, the Fokker fin and rudder has rounded extremities, whereas those of the Heinkel are severely angular. The Dutch machine has a good slope to the straight leading-edge, a nicely rounded apex, a slight slope to the trailing-edge of the rudder, and a rounded heel where the base of the rudder blends into the baseline of the fuselage. It will also be noticed from the side view that the tailplane is set nearly halfway up the fin, but that of the Heinkel is mounted only slightly above the base of the fin.

The He 115's fin also has a straight slope to its leading-edge, but it is a much more abrupt one. Its apex is flat and fairly broad, and it makes a definite right angle with the straight, vertical trailing-edge of the rudder. The heel of the rudder is also severely square — in fact, the rudder itself is virtually a plain rectangle.

To deal now with the tailplane plan, both have a straight, or almost straight, trailing-edge and a backswept leading-edge. But because the Fokker tailplane is of higher aspect-ratio than that of the German machine, this backsweep is less acute. It will also be noticed that the "bite," where the elevators are cut away to allow rudder clearance, is nicely rounded off in the case of the Fokker, but is a sharp-cornered affair on the Heinkel.

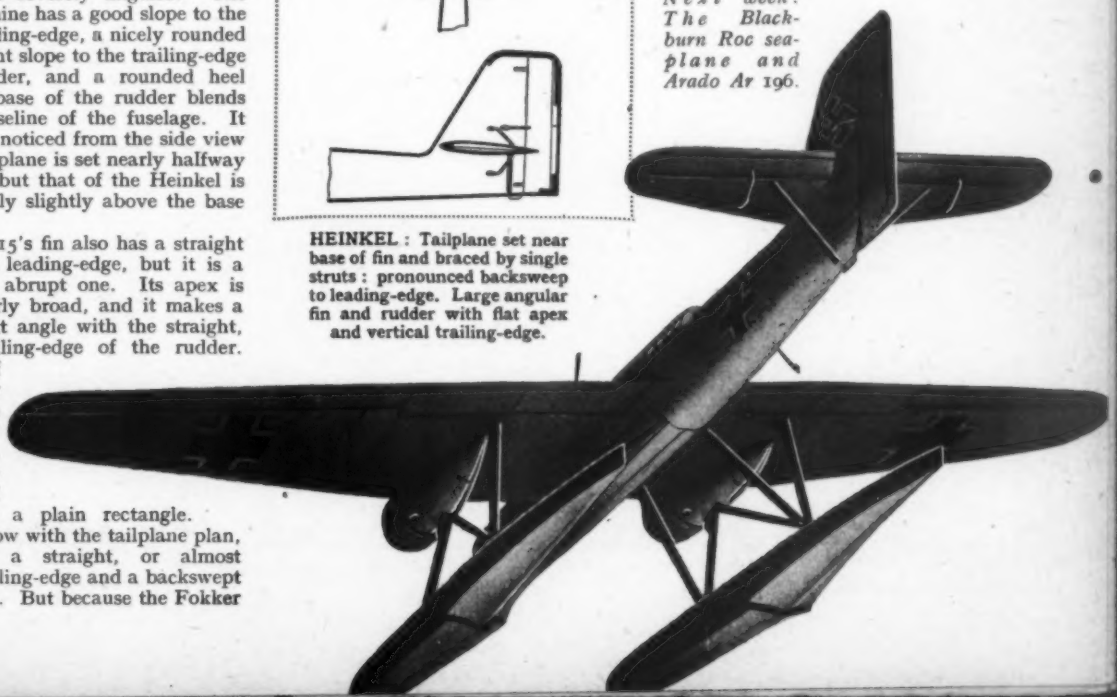


HEINKEL : Tailplane set near base of fin and braced by single struts : pronounced backsweep to leading-edge. Large angular fin and rudder with flat apex and vertical trailing-edge.

Both tailplanes are braced by external struts, but here there is a very obvious difference which will be most helpful to the spotter: the Fokker has a V-shaped double strut (the "V" being the right way up), whereas the Heinkel's tailplane is supported by single struts. The latter machine also has fairly prominent mass balances to both elevators and rudder, which should be visible from a rear view when the aircraft is reasonably close and conditions of visibility are good.

Incidentally, the Fokker* was designed from the start as a torpedo-bomber and reconnaissance seaplane for the Netherlands Naval Air Service, and several operated with Coastal Command R.A.F. after the German invasion of Holland.* The He 115, however, was developed from an earlier civil version.

Next week: The Blackburn Roc seaplane and Arado Ar 196.



AIR PARITY—AT LAST!

A Movie Camera Peeps Back-Stage.

A corner of the wing and tail unit department.

Vast Stores of Many Maintenance Units : Repair of Engines Plays its Part

THE air fleets of Great Britain are no longer outnumbered. That is the heartening news divulged by the Prime Minister.

To keep this great and growing armada in the front line is piled up an accumulation of stores, vast beyond anything the layman has yet realised.

At one of the many maintenance units, dispersed throughout the country, and at a factory where aircraft engines are reconditioned, British Paramount News was recently permitted to make a film, some shots from which are reproduced here. Everything from a split pin to a complete aircraft engine, all in immense quantity, is stored at these maintenance units ready for immediate delivery to any air station in Britain or abroad.

Bomb racks, one of the numerous components of modern aircraft, seem to occupy acres of floor space. The longer the spectator remains in this maintenance unit the stronger his impression, not only of well-nigh unimaginable quantity but of quality. Bomber turrets, often damaged by flak, can be instantly replaced from store.

Regardless of Cost

The American design Browning machine-gun, with which our fighter planes won the Battle of Britain, flows from factory to store, from store to R.A.F. station, in pace with war demand. However much that demand may eventually increase, the stores will be adequate. Each of these Browning guns costs close on £100. Represented in this store is an amount of money that would have given a peacetime tax-payer heart failure. Then there are tyres by the thousand—varying in size, as a small trainer differs from a four-engined bomber. The smallest ones are bought for a mere pound or two, the cost mounting to £25 for the cover used by the giant Stirlings.

Pilots' Irving-type parachutes cost about £60—an expenditure which often brings the highest possible return in precious lives saved.

Now to the engine section. Here there is row upon row of British and American power units—Rolls-Royce, Bristol, Napier and Armstrong Whitworth, Allison, Pratt and Whitney, and Wright, not forgetting the equally famous De Havilland Gipsy that powers the little primary trainers.

Engines of single-seater fighters cost about £3,000

(Continued overleaf)

(Left strip) Shots from the stores. 1 and 2, British and American engines ; 3, Stowing a spare wing ; 4, Rows and rows of machine-guns ; 5, Brownings packed in cases ready for despatch ; 6, Gun turrets ; 7, Bomb racks and flare containers ; 8, Tyres for every type ; 9, Parachutes by the hundred, they are packed by experts as required. (Right strip) New engines for old. 10, Dismantling a damaged Merlin ; 11, Cleaning by high-pressure paraffin and air jet ; 12, Welding a crankcase crack ; 13, Grinding an air-cooled cylinder ; 14, Inspecting a cylinder liner ; 15, Women also play their part, these are inspecting reconditioned engine components ; 16, A repaired engine is reassembled ; 17, Control room in the test house ; 18, A batch of repaired engines ready for delivery.

each, roughly two-thirds of the whole cost of the plane. As there are no fewer than 80 types of British warplanes and 30 American types, the great variety of aircraft stores is easily understood.

Equally important is the part played by the repair and reconditioning of aircraft engines.

"From these operations all our aircraft returned." Yes, but sometimes a bit scarred. Having run the gauntlet of flak and Nazi fighters, some of them need repairs, most of which can be made by the air station ground staff, whose expert handling soon puts the aircraft back on the active list. But until lately, when engines were badly shot up or crashed they were scrapped.

That is no longer so. To a newly equipped M.A.P. factory damaged power units are rushed from the airfield, or where they were crashed, and line up for treatment—some with no more than a clean bullet hole, others so battered that the casual onlooker would say they were a total loss. Now they can be repaired. One engine perfectly reconditioned counts as a new one, and so salvage is hastening air supremacy.

Merely to patch up a wrecked engine was always possible; and if second-rate performance were good enough for the R.A.F., it would have been done long ago. But the engines now being dismantled are not going to be patched up. They will go back into the air equal to new, thanks to revolutionary processes devised by some of the best brains in automobile engineering.

High-pressure air and paraffin vapour cleans off the dirt and blistered paint before repairs begin. One part of the engine to suffer in most crashes is the crankcase. The large cracks that used to mean the scrap-heap are now welded, and the weld is braced with a steel tie-rod, leaving the case as strong as ever.

This particular factory is one of many. The fine show of repaired crankcases here indicates the huge savings effected by the new methods. Ninety-nine per cent. of the engines that come here are successfully reconditioned. Reboring is also carried out. First thickly plated with a hard chromium, the cylinder linings are trimmed down to the original diameter. Worn crankshafts are reground, the connecting rods rebushed, and the whole assembly trued up.

Much of the work is done by girls. By good organising each engine repair is spread over some number of workers employed on the motor's thousands of parts. Many of the lighter components, such as valves (to be cleaned and ground), are as quickly handled by women as by men.

And so the repair process comes to an end. Only reassembling and testing remain. Into the testing bays go the finished power units; scientific instruments locate faults and exactly measure performance. Passed A1, the reconditioned power units go back into fighters and bombers—on active service again.

The repair of damaged aircraft engines achieves a double purpose; it not only puts warplanes back into the air quickly, but it means a great saving in man-hours, materials and money; the most expensive engine repair costs only a fraction of the cost of a new aircraft engine.

In war it takes time for a democracy to get under way. Germany had a long start. Thanks to British and U.S. efforts, the enemy has now been overhauled. Mounting production will maintain not only our present strength but the overwhelming air fleet now in preparation.

BOOK REVIEWS

"Bombers," by C. G. Grey. Faber and Faber; 6s. net.

MR. C. G. GREY has followed up his book "Fighters" with one entitled "Bombers." As one would expect of Mr. Grey, he writes about a good many other things besides bombers—in fact, to be candid, this book is rather discursive. Inevitably he tells a lot of anecdotes—and Mr. Grey's anecdotage is always attractive. Occasionally he inserts the excusing clause "if I remember rightly," and at least once his memory has failed him, for on page 16 he has confused the two attacks made on Zeppelins by Flt. Comdr. Bigsworth and by Flt. Sub-Lieut. Warneford. It was the latter, not the former, who brought down LZ37 (which unfortunately fell on a nunnery) and his reward for this feat was the Victoria Cross. Geography also occasionally lets Mr. Grey down, especially India. On pages 65-66 he writes: "The Punjabi does not admit that he is an Indian, and asserts that India only begins east of the Indus." If he will glance at a map he will see that something like nine-tenths of the Punjab does lie east of the Indus. There are other slips in the book, but we will content ourselves with reflecting that even Homer (yes, and even *Flight*—see page 186 of Mr. Grey's book) nods at times.

More important is the doctrine propounded by Mr. Grey in this book, and two of his conclusions are to be heartily approved. On page 134 he insists that for work with the Army special types of aircraft for dive-bombing and ground-strafing are necessary, and that "the personnel must be trained *with* the Army *for* the Army *by* the Army." Also, on pages 149 and 193, he concludes that bombing by itself cannot win a war. With these doctrines *Flight* is quite in agreement.

Subsequent events in Malaya, however, have proved Mr. Grey to be a singularly poor prophet.

For the rest, we can best give our readers an idea of what to expect in this book by outlining the successive chapters. The first part runs through developments in the last war; the second deals with developments in the inter-war years and includes four chapters which describe at length and in detail movements and personalities in the United States; Part 3 deals with the present war; and Part 4 is called "Aerobiographies," and gives lists of aircraft firms in Britain and the United States, their products, and the personalities in the various firms.

"How an Aeroplane Flies," by C. G. Grey. George Allen & Unwin, 2s.

IN his opening chapter of this little book, Mr. Grey, who is not a qualified pilot, asserts that ". . . many people who know how to fly an aeroplane, and some who fly quite well, have little idea of how or why an aeroplane flies." Our view is that, while it may not be necessary for a reasonably competent pilot to possess the wealth of theoretical knowledge on aerodynamics which the author has compressed within his 86 pages, he must, if he hopes to go on flying in safety, have a fairly good knowledge of why his aircraft flies and, *per se*, the essential conditions to be maintained if it is to remain airborne.

Air Cadets, for whom this little book is intended as a handbook, will learn much from it, but they must always keep in the forefront of their minds that it is *not* entitled "How to fly an Aircraft."

When Mr. Grey deals with the tail unit, for example, he says, under the sub-heading of "Turning," that the primary purpose of the rudder is to make the machine yaw. Aerodynamically speaking, that is perfectly correct, but woe betide the learner pilot who puts it into practice and starts indulging in skid turns!

On the next page Mr. Grey describes how to put a machine into a steep bank and pull it round in a turn by means of the elevators, and this, he tells his young readers, is "the orthodox method of turning." That, again, is not untrue, but it ignores the orthodox method of making a more normal turn requiring less than 45 degrees bank, in which the procedure is distinctly different.

In effect, Mr. Grey is here encroaching on the subject of "How to fly an Aircraft" as distinct from "How an aircraft flies," and, in doing so, is in danger of inviting his young readers to run before they can walk—a mistake no practical flying instructor would make.

"Great Britain and Ireland; Catalogue of Internal Air Mails, 1910-1941." Compiled by N. C. Baldwin. Francis J. Field, Ltd 3s. 6d.

"THE publication of this catalogue during the present exceptional paper shortage conditions," says the preface, "has been possible only as a consequence of American interest in everything in British aero-philately——." It will, of course, be of equal interest to those in Great Britain and Ireland whose hobby is air-philately.

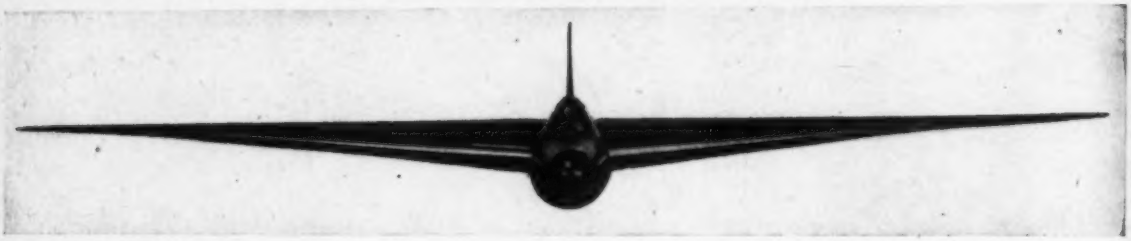
Many readers will perhaps be surprised that air-philately goes back as far as 1910, but one discovers from this interesting catalogue that the very first example was an unofficial effort, unblessed by the P.M.G., inaugurated at the Lanark Aviation Meeting, August 6th-13th of that distant year, and the circular postmark read, "Lanark Grand Stand."

The first official air mail, properly accepted by the postal authorities and duly stamped before flight, bore the circular postmark with the legend, "First United Kingdom Aerial Post; September 13th, 1911, London." This was between London and Windsor and dealt only with some special cards and covers issued in various colours.

But the first *regular* air mail service would appear to have been one run for the postal authorities between Windermere and the Isle of Man in 1917-1918 by naval seaplanes to overcome the U-boat menace in the Irish Sea.

A NOVEL FIGHTER DESIGN

Mr. Davis Produces a Wing of Great Thickness and Low Aspect Ratio : Tip Stalling said to be Avoided



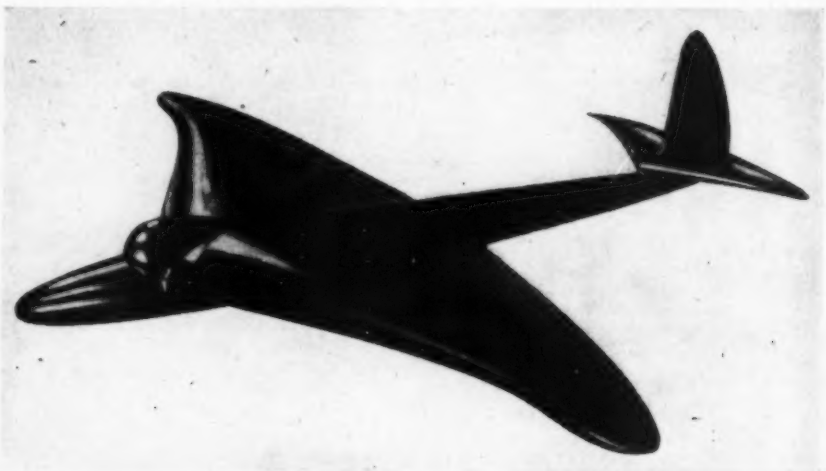
Front view of model of the Manta long-range fighter. Note great wing root thickness.

SINCE young David R. Davis succeeded in persuading the Consolidated people that his formula for calculating a wing section, patented by him in 1934, ample proof of the qualities of the Davis wing has been forthcoming in the Consolidated model 32, better known as the B-24, and in this country still better known as the Liberator, which has a thin wing section of the Davis type, as has also the Catalina flying boat.

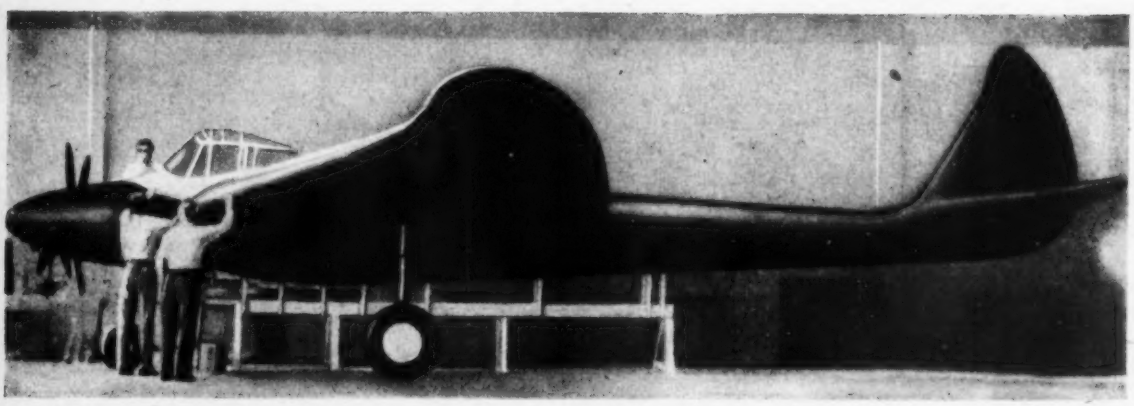
The success of the Liberator has caused most people to think of a Davis wing as being synonymous with a thin wing. That this is not necessarily so seems to be indicated by the news from America that Mr. Davis is producing a long-range fighter a feature of which is its very thick wing. Apparently Mr. Davis has succeeded in forming a company known as the Manta Aircraft Corporation of Los Angeles. His new project is, so far, proved in the wind tunnel only, although a full-size mock-up has been made, and the Manta design office is said to be ready for production.

In contradistinction to the wings of the Catalina and Liberator, the wing of the Manta long-range fighter is of low aspect ratio (6:1 as against 11:1) and of very considerable thickness/chord ratio. The pictures, for which we are indebted to our contemporary, *American Aviation*, show the Manta to have also an unusual plan form. We do not know whether Mr. Davis was led to this by mathematical or by zoological considerations, but it is perhaps, significant that he has chosen to name his machine the Manta, which is the devil fish of the ray family and is not unlike the new fighter, even to the slim fuselage which is not unlike the tail of the ray.

Two years of wind-tunnel research went into the planning of the Manta, and Mr. Davis claims that, in addition to the low drag which is so important for high-speed, long-range work, his new wing has got over the trouble with tip stalling in a very tapered plan form. The mock-up has a wing span of 50ft. and a maximum thickness of 42in., well forward in the section. With an engine of 1,200 h.p., the calculated top speed is 445 m.p.h. when carrying four cannon, four machine guns, and a large ammunition load. Range is estimated to be 2,500 miles.



The model on the right gives some idea of the unusual plan form. (Below) A picture of the Manta full-scale mock-up.



RUSSIA'S AIR POWER

Strategic Resources of Raw Materials : Organisation and Development of the Aircraft Industry : The Staying Power of the Red Air Arm

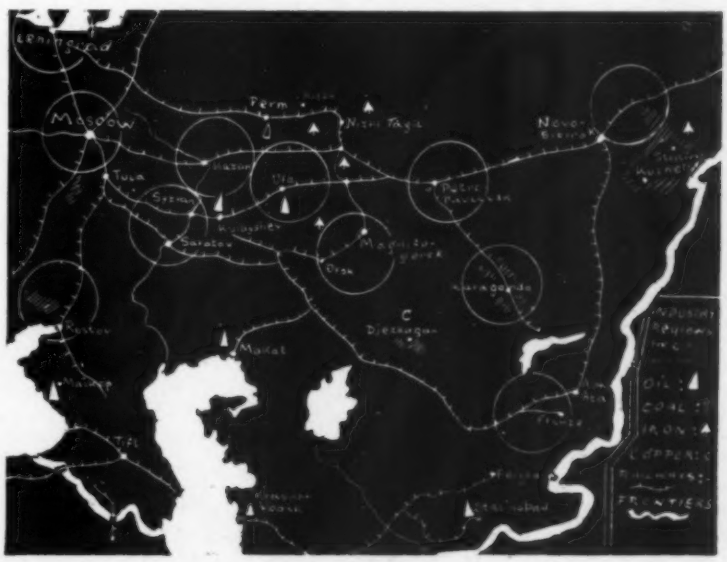
THE watchful inquisitiveness of Russia's aggressive neighbours, Germany and Japan, has made her reticent in disclosing details of her Air Power. It would not at present be in the interest of our Ally to attempt to probe into the statistics of the current production. But certain facts cast an unhesitating light on the vast human and material resources of Soviet Air Power.

Resources in stategic raw materials which form the foundation of an aircraft industry are certainly not lacking in Russia. In 1940 her steel output amounted to 18,400,000 tons, her pig iron to 16,900,000 tons, and her iron ore to 15,000,000 tons. Her production of manganese ore amounted to 41.3 per cent. of the total world output, while from her domestic resources she could cover 87 per cent. of her requirements in aluminium, 99 per cent. of zinc, and 77 per cent. of lead. With bauxite, chromium ore, zinc and lead-ore she is well supplied, but deficient in nickel, molybdenum, tungsten, vanadium and rubber. Synthetic rubber production is said, however, to have been sufficient to cover about 70 per cent. of her annual peacetime consumption.

Centralised economic planning stretching over a period of years, with the emphasis placed on the increase of the war potential, has resulted in accumulation of stocks of deficient raw materials, the development of substitute products and the exploitation of new mineral resources. The increase of bombing range, the changed character of military strategy has been responsible for the steady development of raw material resources and metallurgical production in the inner regions of the Soviet Union where vulnerability is considerably reduced. Thus tin-mining was being developed in Eastern Siberia and Central Asia, zinc working in the Urals and copper and chromium in Kazakhstan.

Already 10 per cent. of the Russian pig-iron output comes from the new Kusnetzk basin, while the rich region of Magnitogorsk has been developed into an important centre of metallurgical production. The foresight displayed by Russian authorities in planning this eastward migration is already reaping rewards, for the existence of a potentially strong base of strategic raw materials in the depths of the country is of paramount value to the staying power of Russia's fighting forces.

The aircraft industry, which has the advantage of such substantial domestic resources has, since its inception,



This map shows Russia's new centres of raw materials and industries strategically situated in the far eastern regions of the country.

GROWING MIGHT: The progress of Russia's aircraft industry is illustrated diagramatically by these figures. Each aircraft symbol represents 1,000 machines and each human figure 50,000 workers employed in the aircraft industry.

enjoyed a special status in the Soviet Union. While consumers' goods have only recently begun to show an improvement in quality of material and workmanship, only the best materials have been used in the production of aircraft. The organisation of this industry is certainly not behind any one of the major world powers. The Commissariat for the Aircraft Industry which controls the entire production has, by virtue of the State ownership of all production resources, far more insight and facility for planned production than elsewhere. Moreover, this centralised planning of the industry eliminates waste and unnecessary duplication in peacetime and co-ordinates production for the exclusive needs of the Air Arm and the State Civil Transport Service.

Similarly, by co-ordination of research, Russia gained advantage over many other countries where research is either only partially co-ordinated in peacetime, or kept secret for reasons of commercial competition, or else not exclusively devoted towards the advancement of military flying. A wide net of laboratories and research institutes is thus organised into the Z.A.G.I., the Central Aero-Dynamic State Institute, the Z.I.A.M., the Central Research Institute for the development of aero-engines created in 1930, and the V.I.A.M., which is in charge of testing and accepting.

As far back as 1936 a German military expert wrote that "there is probably no other country with such a network of experimental stations, laboratories and training centres, the efforts of all of which are being exclusively devoted towards the development of the Soviet Air Arm to the highest possible level of technical perfection."

Technical Efficiency

The technical efficiency of the Russian aircraft industry does not seem to be lagging behind that of other air powers. The first few years of material destruction and general reduction in technical efficiency (after the October Revolution) were followed by an intensified drive towards improvement of the production process and efficiency. In the years of economic collaboration with Germany, Russia's mechanics, foremen and technicians had an easy access to German factories and workshops, studied their methods and made good use of them. Later on, American and other foreign technicians have been employed to initiate and train Russian workers in the various skilled trades of aircraft and aircraft engine construction. With the continuous expansion of local training facilities the technical efficiency and productivity of Russian labour has indeed shown a rapid progress.

Thus during 1932-1937, the increase of labour productivity planned at 63 per cent. actually rose to 82 per cent. Productivity of labour in the first half of 1938 increased by a further 15.5 per cent. compared with the corresponding period of 1937. In 1940, on the initiative of Stalin, the net of trade and industrial training centres was further expanded to provide, by 1941, a new cadre of 794,000 young skilled workers.

The drive towards increased efficiency of labour is not only the concern of the planning authority; to the wide masses of Russian workers the names of "shock-workers" or "Stakhanovites"—men and women who have achieved record production output—are the embodiment of their ambitions. Such attitude of the working masses, supported by the scientific planning of organisation, naturally tends to increase constantly the already high production efficiency. What has been achieved in this line is best shown by Lord Beaverbrook's statement on his return from Russia that "the Soviet aircraft and engine factories were placed for efficiency and capacity on the level of performance we have reached in this country and in the United States."

Some Bottle-necks

Nevertheless, Soviet aircraft industry, although steadily expanding, suffered from a number of weak spots and bottle-necks from which it only gradually recovered in the last few years. The chief weakness was the backwardness of local designing skill, which made it necessary to rely on foreign designs. The authorities responsible for the creation and development of the aircraft industry have closely followed developments in other European countries, and U.S. licences for the construction of aircraft and engines have been acquired, in some instances together with the manufacturing equipment. In this way it was thought

WELL EQUIPPED: This snap of two Soviet pilots clearly shows the good quality of their clothing and equipment. It will be seen that their parachutes are of the Irving type and that their flying boots have fur on the outside.

POWER

possible to overcome the delays unavoidable in building up an aircraft industry from scratch. The political complications involved in the sale of the very latest designs are self-evident. Furthermore, in this way it was easier to start production; the difficulty of improving and keeping abreast of technical developments in other countries, such as Germany and the U.S., is obvious.

Similarly, the co-ordination between the various branches of raw materials supply, accessories industries, and transport was yet imperfect; the difficulties of the raw materials and accessories supply branches resulted thus in frequent bottle-necks, which could only be remedied by purchases from abroad.

Development of Design

The relentless attention paid by the Soviet Government to the development of the aircraft industry has indeed succeeded not only in eliminating the above difficulties but also in freeing the production from dependence on foreign assistance. Russian designs, though some of them still showing "cross-bred" features, came more and more into prominence. The trans-arctic flights of Russian pilots in machines of domestic design and construction and the achievements of the Russian Air Forces in the present war bear ample evidence of the skill of Russia's designers and the quality of workmanship.

In fact, with all the ailments which necessarily had to accompany the "childhood" period of the Soviet aircraft industry, the rate of output as reported by many experts has been maintained for some years now at a high and steadily increasing level. Based on such reports (which can be considered reliable) the picture graph shows the progressive expansion of the Russian aircraft industry.

The following are representative types of military aircraft produced by this industry:—

FIGHTERS:

I.P.—Single-seater fighter, first completed in 1937. Armed with two cannons in the wing and two machine-guns firing through the airscrew. Range, 500 miles; speed, 305 m.p.h.

I.15 "Chata" biplane.—To-day certainly an obsolete type. Original type powered with M-25 radial engine of 750 h.p., and has an upper plane cranked downwards to the fuselage. A second version is the

I.15B, which differs from the former by its upper plane, which continues above the fuselage. Powered with an M-63 engine of 1,000 h.p. Max. speed, 205-230 m.p.h. Third version is

I.15C, with a retractable undercarriage and fitted either with wheels or skis. Powered also with a 1,000 h.p. engine. Max. speed, 240 m.p.h.

The "Chatas" are armed with four machine-guns firing through the airscrew circle and were already in service in the Spanish Civil War.

I.16 "Rata."—Single-seater monoplane, the original powered with a M-25 radial engine and armed with four machine-guns. Another version is the

I.16B, fitted with a 1,000 h.p. engine. Armed with two machine-guns mounted in the fuselage and two 20 mm. cannons in wings.

I.16C is powered with a 1,000 h.p. twin-row radial engine, and has the same armament as the I.16B. Max. speed, 300 m.p.h.

A further development of the "Ratas" are the I.26 and the I.61.

I.26 is a low-wing monoplane with a retractable undercarriage. Liquid-cooled engine and radiator mounted beneath the rear half of the fuselage. The large air intake probably supplies the air to the oil cooler and the supercharger. The armament, composed of two synchronised machine-guns mounted on top of engine, is clearly below accepted modern standards.

I.61 is fitted with a liquid-cooled engine and has a slender fuselage nose portion. Otherwise as I.16.

More modern developments are the I.17, I.18 and I.19.

I.17 is a single-seater low-wing monoplane. Metal monocoque fuselage, with wings in three sections: centre portion sheet covered; outer panels, ailerons and tail surfaces fabric covered. Powered with the M-100 liquid-cooled 12-cyl.-in-line engine of 860 h.p. Armament: Four machine-guns firing clear of the airscrew circle. Small fragmentation bombs up to 220 lb. can be carried in racks on the underside of wings. Range, 500 miles; ceiling, 36,000 ft.; cruising speed, 273 m.p.h.; max. speed, 305 m.p.h.

I.18 resembles, as does the I.17, the Vickers Super-

ALL PRESENT AND CORRECT! A line up of I.16 fighters on a Soviet airfield. This radial-engined model was the first of the "I" series monoplanes and was widely used early in the war. It is known as the Rata.

SPANISH VETERAN. The I.15B, a development of the I.15, Chata, which did useful service in the Spanish war and is probably still to be seen occasionally in action.

RUSSIA'S AIR POWER

marine "Spitfire." Powered with a liquid-cooled engine of 1,250 h.p., and armed with six machine-guns and a 20 mm. cannon. Max. speed, 400 m.p.h.

New types of aircraft are known to be in service with the Russian Air Forces. Ground-attack planes armed with six and eight machine guns and a small-calibre cannon firing armour-piercing projectiles are already in use against German Panzer Divisions. Detailed information about these types has, however, not yet reached other countries.

BOMBERS:

P.2 (BB-22) Light and Dive-bomber. Modern low-wing monoplane with strongly tapered wings swept forward and fitted with split flaps. Retractable undercarriage. The twin-rudder unit consists of two end plates mounted on the stabilisers which have a slight upward dihedral.

Powered with two liquid-cooled engines.

S.B.2 (ANT-40), also known as PS-41 as troop-carrier. Various versions powered with Wright Cyclone or Gnome-Rhone K-14 (or M-85) 800 h.p., or liquid-cooled engines of the type of M-34 830 h.p. or M-100 of 1,000 h.p.

Twin machine-guns in the fuselage and one machine-gun each in defensive stations mounted in the top and bottom of fuselage. Performance: Maximum speed, 260-274 m.p.h. Climb to 16,400ft. in 9.5 min. Ceiling, 28,000ft. Range (from 600 miles) and bomb load (from 1,700 lb.) vary according to version.

ONE OF THE FAMILY: This picture of the I.26, one of the Red Air Force's modern fighters, shows the probable influence of British design. The lines of the fuselage and fin closely resemble the Spitfire, while the wings and undercarriage suggest the Hurricane.

The March of the Bomber

The initial period of the development of the Russian bomber was marked by the preference for the heavy multi-engined type. The "giganto-mania"—as the Russians nicknamed their liking for the "colossal"—was the expression of the Russian conception of strategy in future wars. Since 1936 a gradual replacement of the heavy bomber by the medium and lighter type took place and bomber squadrons are equipped with these new types.

The main exponent of the heavy class is the T.B.6, a low-wing monoplane constructed with a metal frame fuselage and wings, covered with corrugated sheet skin. This type was influenced by Prof. Junkers, who was the mentor of the Russian designer. Fitted with a semi-retractable undercarriage, the T.B.6 was powered with four M-34 liquid-cooled engines of 950 h.p. each. Maximum speed, 220-250 m.p.h. Climb, 13,000ft. in 24 min. Bomb load, 3 tons.

Of the new trend of development, the following are the representative types:—

Z.K.B.26, powered with two M-100 liquid-cooled 12-cyl. engines of 850 h.p. each or two Wright Cyclone 750 h.p. radials. The prototype became known in a record flight with 2,200 lb. useful load at 202 m.p.h. over a distance of 3,100 miles and with a ceiling of 40,000ft. Derivated from this type is the

D.B.-3, powered with two M-87N air-cooled twin-row radials of 950 h.p. each. Crew 3-4. Armament comprises three machine-guns, at least one of which mounted in the rotating fuselage nose turret and one in a cupola mounted in the rear portion of the fuselage underside. The gross weight is 33,000 lb. Bomb load 1,100 lb. Range, 2,500 miles (5,500 lb. bomb load for 750 miles). Maximum speed approximately 250 m.p.h. Climbs to 13,100ft. in 12 minutes. Ceiling 28,000ft.

D.B.-3A is the latest version of the above. Has a new wholly transparent nose portion replacing the above. Machine-gun cupola beneath fuselage and retractable. Carries 4,400 lb. at 265 m.p.h.

Organisation

The period of 1936-39, during which the medium bomber gained predominance, was also marked by important changes in equipment and improvements in organisation of the Russian Air Force. While the Commissariat of the Navy is in charge of the Fleet Air Arm, the People's Commissariat for Defence co-ordinates the Army Air Forces. Army Air Units were divided into autonomous formations and Army Co-operation Units. The autonomous formations each consisted of one Heavy Air Corps comprising two Bomber and one Parachutists' Brigade. The Army Co-operation Units embraced fighter, dive-bomber, reconnaissance and general-purpose units. In addition, in the West, fighters were organised into brigades and entrusted with the protection of strategical points and the operations of the heavy units.

Basic formation is the "zveno"

UP-TO-DATE: Here is the I.61, also known as the I.200, which is one of Russia's very latest single-seater fighters. It is powered by the liquid-cooled AM35A engine which develops 1,200 h.p. Its armament consists of four machine-guns, two heavy types and two of rifle calibre.

RUSSIA'S AIR POWER

(flight) composed of three aircraft. Three flights form an "otriad" (squadron); three otriads an "eskadrilla" (wing); three wings constitute a "brigade," and three brigades an aviation corps.

Attached to each corps is a number of air bases with transport planes, petrol stores and ground personnel. Such elastic organisation seems to be admirably suited to Russian conditions.

Estimates of the strength of the Soviet Air Force have always varied according to the political views held by the writers. Official Russian statistics show the following composition of the Russian Air Force in 1939:—

Heavy Bombers	20.6 per cent.
Medium Bombers	26.0 ,, ,,
Fighters	30.0 ,, ,,
Other Types	23.4 ,, ,,

The simultaneous bomb volley has increased from 2,400 tons in 1934 to 6,600 tons in 1939.

Supported by such data of aircraft as is available, we arrive at the following estimate of the growth of the numerical strength of the Soviet Air Force:—

	Heavy Bombers	Light Bombers	Fighters	Total
1934 ..	259	1,225	226	2,440
1939 ..	1,444	1,822	2,103	6,160

Adding to that total the number of aircraft supplied to the Air Arm by the Soviet aircraft industry, estimated at 8,000 complete machines, we arrive at a figure of 15,000 first-line planes with which the Soviet Union entered upon her heroic struggle against the Germans.

Personnel

The personnel resources of the Russian Air Force are vaster than in any other country. In 32 special schools training the Air Force personnel, 20,000 of the best young men were trained in 1939, the intake substantially increasing in 1940. Service is for three years; pilots have to show a minimum of 250 solo hours before being posted to operational units.

Nothing could better testify to the efficiency of the personnel than the toll they have taken of the *Luftwaffe*. Since the beginning of the fighting considerably more than 6,000 machines of the *Luftwaffe* have been destroyed. The Soviet Air Force has not only to give continuous battle to the *Luftwaffe*, but is also effectively employed against the Panzer divisions. In ten days of the battle for Moscow alone, Russian dive-bombers destroyed 235 tanks, 357 lorries with troops and ammunition, and various other enemy transport.

The fuel resources of Russia's Air Force are, perhaps, the main envy of the Nazi aggressor. In 1940, the output of oil and gas amounted to 34,200,000 tons. Although the Caucasian oilfields still form the main basis of supply, efforts have been made during the past few years to develop the vast oil resources in the strategically securer regions of Russia, such as the Bashkir, Daghestan, Tadchik Republics and the Volga-Urals sector. Thus the refinery in Ufa has been established to produce a 95-octane aviation spirit at an initial output rate of 40,000 tons per annum, increased to 140,000 tons in 1940-41.

These complementary sources of supply are capable of sustaining the Russian Air Force with the vital fuel should the main sources in the Caucasus be endangered. American help with drilling equipment and other machinery should enable Russia to develop fully her vital sources of fuel supply.

The Present Situation

To-day Russia is in need of aircraft, but not because her air power has been wiped out of existence by the *Luftwaffe*. The toll Russia's Air Force has taken of the *Luftwaffe* could not have been achieved without considerable losses to themselves. In the initial stage of the war the Russians lost numbers of their planes on advanced airdromes in Poland and Lithuania. At the same time, German claims to have destroyed 25,000 Russian aircraft—or considerably more than the total number with which they entered the War—are but wishful thinking. Daily reports from the Russian front are a vivid proof to the continued vitality and striking power of the Soviet Air Arm.

Despite the heavy losses suffered from a formidable enemy, Russia still keeps a wary eye on her unreliable Eastern neighbour, Japan. Before the war, one-third of her total air fleet had the task of guarding her Eastern approaches.

Such of her industries as were situated in the territory now occupied by the enemy, or in the immediate danger zone, are obviously a total loss. The rhythm of aircraft production in the important industrial regions of Moscow, Leningrad and the south has been certainly disturbed. Military interference with her already overtaxed transport system is yet another obstacle to the smooth operation of the aircraft industry.

The German retreat from the Moscow region and from the south is thus of immense value to aircraft production: the relief from the danger of immediate enemy assault will help to restore some normality in the production system of this region. Meanwhile the Russians are losing no time to increase and accelerate the production in those aircraft factories which have been established in the strategic Eastern zone. Based on the supply of raw materials from this zone, Russia's aircraft production will continue to sustain the Air Arm in their gallant fight.

FERRY PILOTS

The Crown Film Unit Shows the A.T.A. at Work

FROM time to time the Air Transport Auxiliary, the value of whose work in ferrying aircraft is beyond question, has received its meed of publicity in the columns of the Press. Now a film has been made about it and, in contrast to some of the colourful articles which have appeared in the daily and Sunday newspapers, the film bears the stamp of authenticity one would expect in a production of the Crown Film Unit.

That is not to say that "Ferry Pilot" is a piece of unrelieved official propaganda. On the contrary, it contains a very pleasant leaven of dry humour, a few excellent flying thrills and a bit of dramatic suspense when an A.T.A. pilot, delivering his first Whitley, unknowingly heads for a bunch of raiding Jerries and is attacked.

The film, which opens with the C.O. of the ferry pool working out the details for the day's work and allocating the various jobs, gives a very good idea of an average day in the life of the pilots, but one feels that a little more footage might have been devoted to the women's share in this work, of which one is only given the merest glimpse. Perhaps it was felt that the newspapers had already boosted them sufficiently!

A particularly interesting sequence is that devoted to some brilliant aerobatics by the test pilot at a "Midland Spitfire factory." One of the ferry pilots refers to him as "Alec," so there are no prizes for guessing his identity.

This little film was well worth making; it is also well worth seeing.

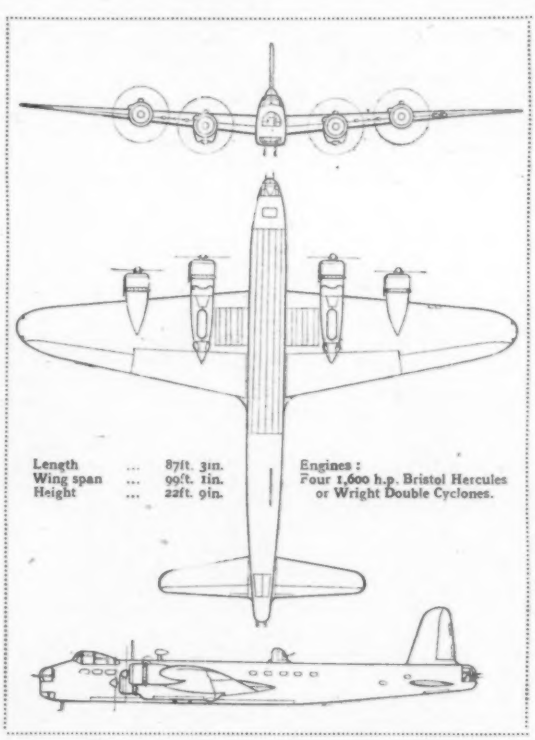
The SHORT STIRLING

First Details of Great Britain's Biggest Bomber : A Four-engined Type with Fighter Manœuvreability

ALMOST since the earliest days of flying the name of Short Brothers has been associated with marine aircraft. Short seaplanes made history even before the war 1914-18, and during that war the "Two-two-five" particularly became famous in the Royal Naval Air Service. From then onwards Shorts specialised on seaplanes, first twin-float types and afterwards flying boats. Of the latter the Empire boats, with variations, and the Sunderland are particularly noteworthy and are doing excellent work in the present war.

Landplanes

Although they specialised on seaplanes, Short Brothers did not neglect the landplane entirely. Every now and then a landplane would make its appearance at Rochester, as if to prove that the firm was quite capable of producing aircraft of that class if they were in demand. Actually, it may be said that, although all-metal marine aircraft were to become the firm's very special trade, it was with a landplane that the foundation was laid. In 1919 Mr. Oswald Short produced the first all-metal, stressed-skin aircraft, the *Silver Streak* biplane. This did not go into production as a type, but the principle of fuselage construction used in it was that which has since been developed and now forms the basis of all modern Short aircraft. In more recent times there was the Scylla landplane, which really was the biplane wings of the Kent class flying boat mounted on a metal fuselage instead of the hull.



Until production of the Short Stirling was undertaken, the Scylla was the largest landplane built by Short Brothers. The long and successful experience with flying boats, however, was in itself a guarantee of the firm's qualifications to undertake the work of designing and building a large bomber, but to make assurance doubly sure it was decided to construct first a flying scale model of the bomber which was to become famous as the Stirling. One of our pictures shows this machine, which was a fairly faithful model. The Pobjoy Niagara IV engines were practically half-size (in scale, not in power, of course) of the Hercules engines of the large machine. The same might be said of the airscrews, so that slipstream effects were quite well represented in the model. The only thing, as Mr. Lankester Parker, Short's chief test pilot, used to say, which was not to scale was the pilot, who had to look out through a windscreen several sizes too small for him. However, the flying scale model provided the information required, and when the Air Ministry's specification for a high-speed long-range bomber was issued in 1936 the firm was ready to undertake the work.

The prototype aircraft, and the first of the production machines, were built by the

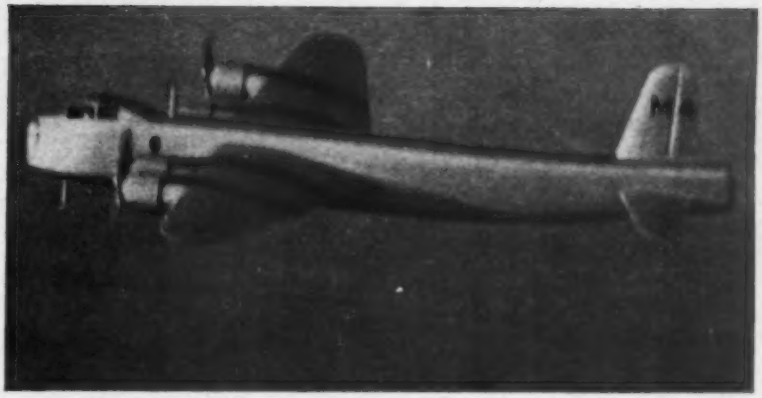
parent company, but it was obvious that the heavy demand could not be met in time by the existing facilities, and the Stirling is now produced, in the form of main components, in more than twenty different factories, in addition to a large sub-contracting scheme for the supply of smaller components.

Recently the Ministry of Aircraft Production arranged for a party to visit a selected group of works so that activity on this, Great Britain's biggest bomber, could be appreciated. The huge workshops and lines of production on such a massive type form a most impressive sight.

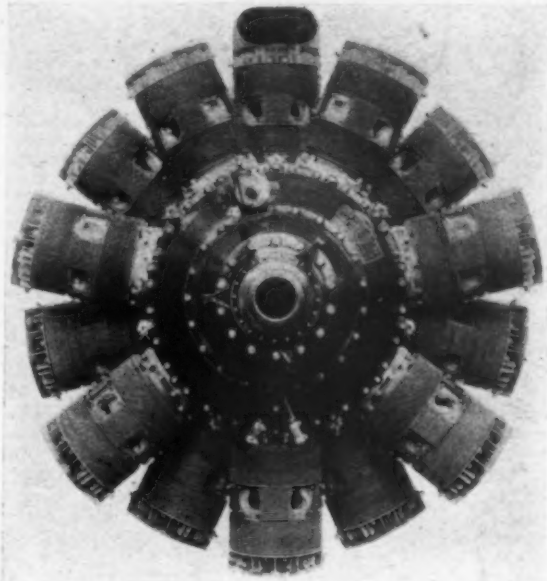
Some delay was caused by a mishap to the first machine, the undercarriage of which collapsed on the first landing. The trouble was, however, tracked down (it was, we believe, caused by the binding of a wheel brake), and in all subsequent aircraft the undercarriage has functioned as intended.

In its general design the Short Stirling is a mid-wing cantilever monoplane with four engines mounted on the leading-edge of the wings. The standard power plant is the Bristol Hercules sleeve-valve 14-cyl. radial air-cooled, of 1,600 b.h.p. maximum power at 2,900 r.p.m. Arrangements have, however, been made for the fitting, as an alternative, of four American Wright Cyclone engines of the same power. As not only the size and weight, but also the power, of the two engine types are almost identical, it may be assumed that the performance will be very much the same whichever is fitted. On the score of decibels, however, the Cyclone wins easily. Its noise is deafening.

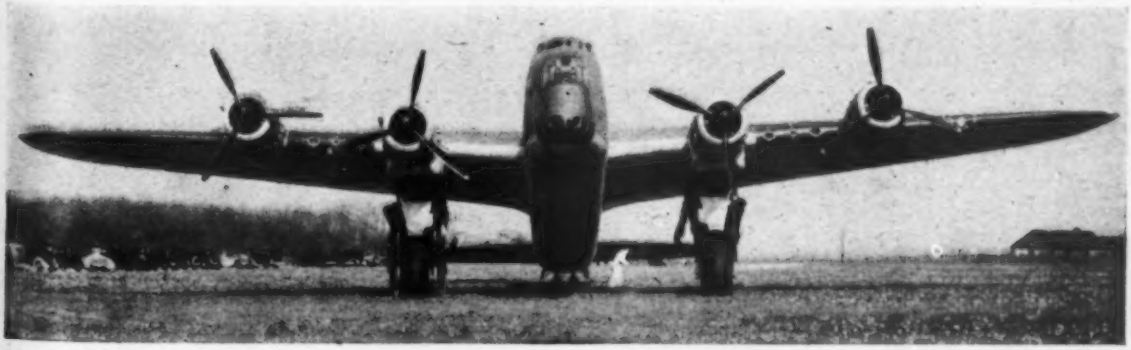
The choice of the mid-wing position was probably dictated partly by aerodynamic and partly by operational considerations. The placing of the wings on the sides rather than at the bottom corners of the fuselage causes less interference with the air flow, calls for small fillets or no fillets at all, and has much to recommend it aerodynamically. The fact that to get the high performance aimed at it was necessary to house the bombs in the fuselage made it necessary to raise the wing so as to leave a clear space in the floor, so that here again the mid-wing arrangement was logical. Aircraft design is always a compromise; in this case the "price to be paid" for the advantages of the mid-wing arrangement was a rather tall undercarriage, which must weigh rather more than the shorter undercarriage of a low-wing monoplane. However, it was decided that the mid-wing arrangement was preferable, and so the basic outline of the Stirling was settled.



Everything to scale except the pilot. This four-engined half-scale flying model, with four 90 h.p. Pobjoy Niagara engines, was built in 1936 and thoroughly flight-tested before the Stirling was built. This exclusive *Flight* photograph shows the similarity between the model and the full-scale machine.



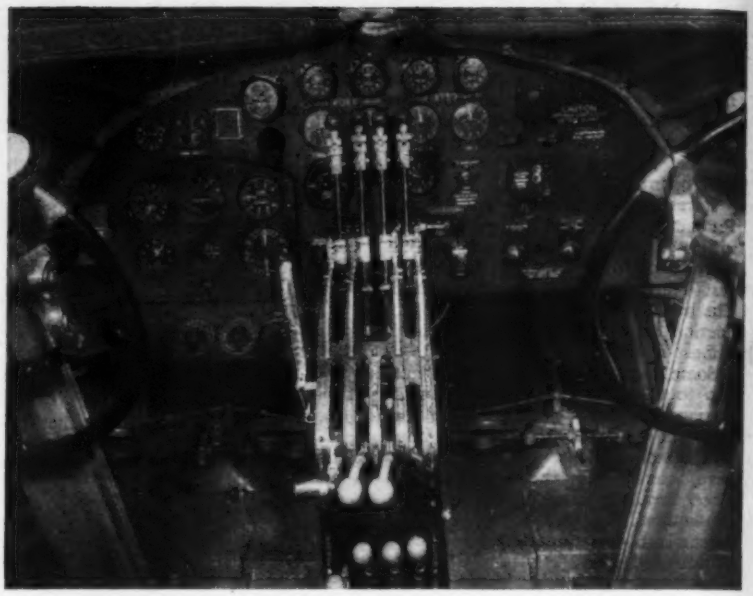
One of the four. The Bristol Hercules 14-cyl. sleeve-valve engine fitted in the Stirling develops a maximum of 1,600 b.h.p. at 2,900 r.p.m. The Wright Cyclone, which forms an alternative power plant, is of the same power (at 2,400 r.p.m.), but has poppet valves.



This front view of the Stirling shows the large ground angle and the placing far out towards the wing tips of the outer engines. The airscrews are de Havillands of the fully feathering type.

THE SHORT STIRLING

Two more factors influenced the design: The wing span was limited by the Air Ministry to 100ft.—from considerations of hangar space, one presumes—and the fuselage dimensions were largely determined by the size of packing case needed. Within those restrictions the Stirling took shape. There seems to be little doubt that if the designers had had a free hand they would have chosen a wing of greater span and higher aspect ratio for efficiency. On the other hand, it may well be that had such a wing been fitted the amazing manœuvrability of the Stirling would not have been achieved. As it is, pilots say that the machine can be "thrown about" almost like a fighter, and in a scrap that is a feature well worth having, and has doubtless played its part in making the Stirling such a formidable antagonist.



For a four-engined aircraft the instrument panel and controls of the Stirling are very simple. The reason is that a flight engineer is carried, who has his separate instruments elsewhere.

Well-tried Methods

In the primary structure of the Stirling one finds obvious evidence of its flying boat ancestry. The wings are almost identical, so far as the type of design is concerned, with those of the Empire and Sunderland boats. The fuselage, apart from the fact that it has, of course, no step, shows a form of construction very similar to that of the boat hulls.

The outward shape of the fuselage is a very straight top, a flat bottom, and nearly flat sides. The corners at top and bottom longerons are, of course, rounded off. Frames are of Z-section, and the longitudinal stringers are a cross between V- and U-sections, that is to say, a U with corners instead of a smooth curve. For many years it was the practice of Short Brothers, in their flying boat hulls, to cut the stringers at the points of intersection with the frames, and to attach them by gussets. In the Stirling fuselage, however, the stringers are continuous and the frames notched for them. From a strength point of view there is probably nothing to choose between the two methods, but it appears likely that in assembling, the type of construction chosen is slightly quicker.

As high speed in addition to great load-carrying capacity was demanded, everything possible had to be done to obtain a smooth finish. This meant that all external rivet heads had to be flush with the surface; it also meant that free edges of skin panels could not be tolerated, but had to be joggled at the joints. All of which added to manufacturing difficulties, but was, presumably, deemed necessary. One does rather wonder whether the few miles per hour thus gained are worth the extra trouble. If the surface were left smooth the saving in drag might be considerable, but by the time it is camouflage painted there is probably not much gained.

Wing Structure

The wing structure, as already mentioned, follows closely that of the Short flying boats. Basically it is a two-spar structure, with spar flanges of extruded T-section, and top and bottom flanges connected by a tubular N-girder arrangement. This form of construction has been found excellent in the boats, and there was thus no reason for changing it in the landplane bomber. One minor change is that the inter-spar bracing is now of the

The motor cyclist in the foreground gives "scale" to this picture of the Stirling. The camouflage painting of this particular specimen shows it to be intended for daylight operations. The two side-by-side tail wheels may be noted.

THE SHORT STIRLING

same tubular form as that of the spars themselves, whereas in the boats it took the form of tie-rod tension members.

Plug Connections

An interesting feature of the Short type of wing truss, and one which facilitates assembly, is the type of plug end used. Instead of the usual plug with plain or forked lug, the Short plug is rather in the form of a piston, with the lug coming down from the crown. The "skirt," to continue the simile, makes very easy the operation of riveting the plug to the tube end. Wing covering is of aluminium-alloy sheet, riveted to spars and rib members, and the leading-edge is a separate structure, portion of which contains tanks. As in the Short boats, the rear portion of the wing, from rear spar to trailing-edge, is a light tubular girder structure.

The wings of the Stirling are, surprisingly enough, designed to be assembled in one piece; that is to say, on each side, port and starboard, the wing is in one piece from fuselage side to wing tip. The T-section spar flanges are, of course, in shorter sections, as they taper from root to tip, and machining down from the root size would waste a lot of material and time.

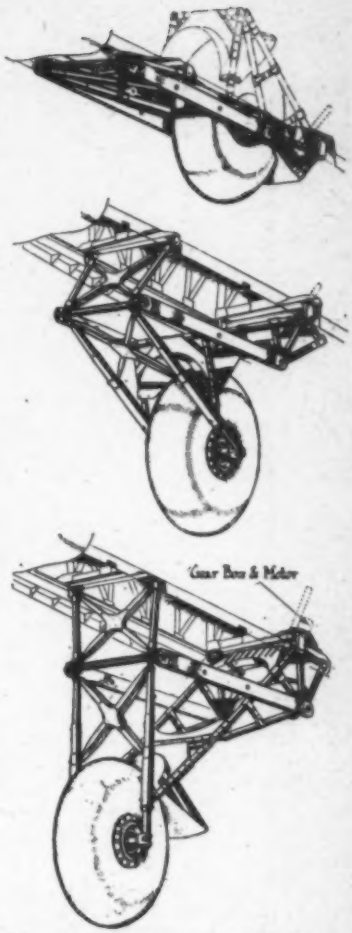
Inside the fuselage the main wing structure, so far as the spars are concerned, runs through from side to side. More unusual is the fact that the top wing covering is also continued across the fuselage. Presumably this was done for purposes of strength, but the top of this centre section also makes a useful storage space for small articles. In the centre of it is cut a large circular hole, so that a member of the crew may stand up here and be within reach of any of the stored articles.

A feature which the Stirling also shares with the Short flying boats is the single fin and rudder. Their shape is different, and the area is smaller, owing to the fact that there is not, as in the fore body of the flying boat hull, a large vertical area forward, and therefore the rudder volume needed is not so great.

The control surfaces are of the type familiar from the Short boats. The same type of Gouge flap is used. This resembles somewhat the American Fowler flap, but there is no gap between it and the main wing, and the flap works solely by the increase in area and angle of incidence. That this increase in area is substantial will be gathered when we point out that the chord of the flap is 48 per cent. of the main wing chord.

Unusual Undercarriage

Reference has been made to the lengthening of the undercarriage caused by placing the wing midway up the fuselage sides. In addition to the extra weight which this entailed, the design of the undercarriage structure itself was rendered more difficult, as the long struts and bracing members as well as the wheel had to be accommodated between the wing spars. The design evolved makes use of a sort of double-jointed arrangement which looks somewhat complicated, but which is actually about the simplest that could function faultlessly. It must be remembered that the loads to be supported are very great.



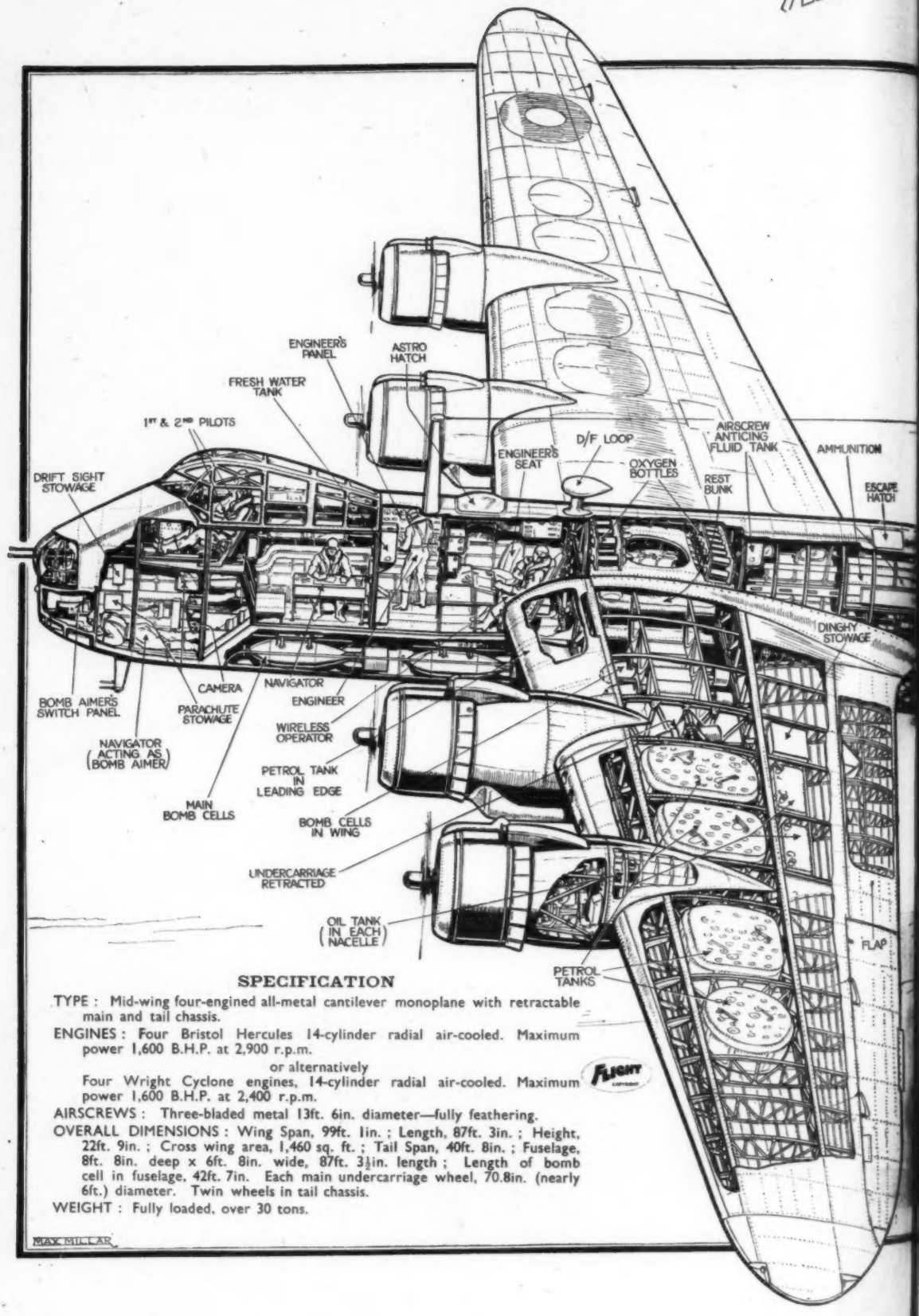
Three stages in the lowering of the undercarriage of the Stirling, showing how struts as well as bracing members are "broken" in the folding process.

Twin tail wheels, linked together by chain and sprockets, are used on the Stirling in order to avoid too large a diameter, which would encroach on the space in the tail turret.

When retracted the undercarriage is housed in the inboard engine nacelle; all, that is, except a small portion of the wheel, which projects but is quite well faired by the doors and the fairing, which is of plastic material. Landings can be made with the wheels retracted, and the very sturdy bomb bay in the floor of the fuselage has been found to prevent serious damage to the main fuselage structure. The wheels are Dunlops, with a tyre diameter of about 6ft. and a tyre width of 28in. Each wheel weighs 764 lb. complete, a figure which will give some idea of the weight of the aircraft. Operation of the undercarriage is electric.

In order to avoid encroaching on the space for the gunner's cockpit in the stern, a very unusual expedient has been adopted: two tail wheels are fitted to keep down the diameter. They retract into the fuselage.

The four Bristol Hercules engines



SPECIFICATION

TYPE : Mid-wing four-engined all-metal cantilever monoplane with retractable main and tail chassis.

ENGINES : Four Bristol Hercules 14-cylinder radial air-cooled. Maximum power 1,600 B.H.P. at 2,900 r.p.m.

or alternatively

Four Wright Cyclone engines, 14-cylinder radial air-cooled. Maximum power 1,600 B.H.P. at 2,400 r.p.m.

AIRSCREWS : Three-bladed metal 13ft. 6in. diameter—fully feathering.

OVERALL DIMENSIONS : Wing Span, 99ft. 1in. ; Length, 87ft. 3in. ; Height, 22ft. 9in. ; Cross wing area, 1,460 sq. ft. ; Tail Span, 40ft. 8in. ; Fuselage, 8ft. 8in. deep x 6ft. 8in. wide, 87ft. 3⅛in. length ; Length of bomb cell in fuselage, 42ft. 7in. Each main undercarriage wheel, 70.8in. (nearly 6ft.) diameter. Twin wheels in tail chassis.

WEIGHT : Fully loaded, over 30 tons.

MAX MILLAR

BRITAIN'S BIGGEST BOMBER

THE FOUR-ENGINED SHORT STIRLING WHICH CARRIES UP TO EIGHT TONS OF BOMBS

An Exclusive Drawing for "Flight" by M. A. Millar

PERFORMANCE

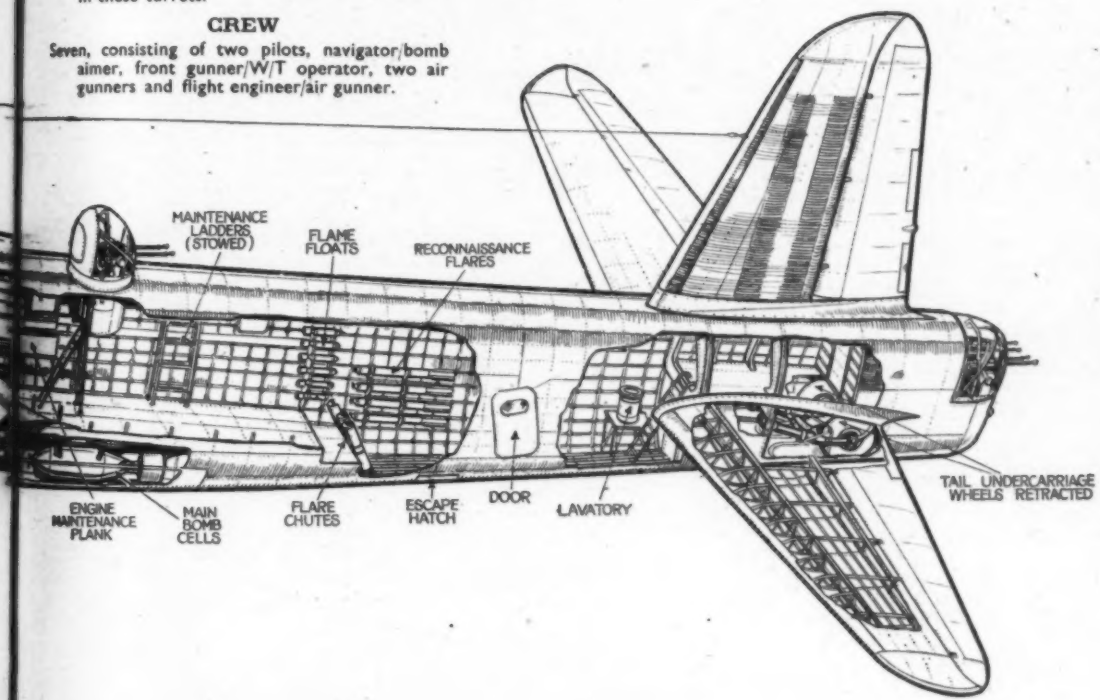
Maximum speed, approximately 300 m.p.h. Range over 2,000 miles. Capable of carrying 8 tons of bombs.

ARMAMENT

Three .303in. gun turrets, situated in the nose, dorsal, and rear positions of the fuselage. Altogether 8 Browning guns are mounted in these turrets.

CREW

Seven, consisting of two pilots, navigator/bomb aimer, front gunner/W/T operator, two air gunners and flight engineer/air gunner.



THE SHORT STIRLING

are mounted, as in the Empire and Sunderland boats, in complete nacelle monocoque units bolted to the front wing spar, the tail portions of the nacelles fairing into the wing surface. Fuel is carried in cylindrical tanks in the wing, outboard of the wing bomb cells. The absence of fuel in the fuselage, and the use of self-sealing tanks, reduces fire risk to a minimum. The engines drive three-bladed fully feathering airscrews of 13ft. 6in. in diameter. They are fitted with de-icers.

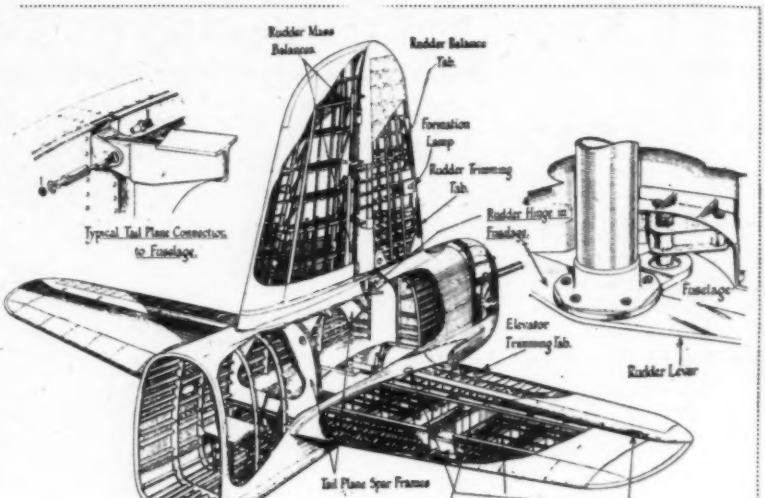
A Crew of Seven

Before describing the internal lay-out of the Stirling it may be mentioned that it carries normally a crew of seven: First and second pilot; the navigator, who is also the bomb-aimer; the front gunner, who is also W/T operator; two air gunners; and the flight engineer, who mans a gun when required.

In the extreme nose of the fuselage is the bomb-aimer's compartment, situated under the floor of the pilot's cabin and nose-gun turret. In this compartment is also a trap-door by which the crew may enter and leave the machine. The nose turret is, of course, power-operated and contains two .303 Browning machine guns.

The pilots are seated side by side, with quite a wide space between them. The coupé top of the compartment affords an excellent view in all important directions, and under it is also provided a station for the fighting controller, who superintends the air gunners when an action is going on. From his position he has a fairly good view when standing up, and protection is provided for him in the form of hinged armour plates which swing out of the way when not in use. The first pilot has armour plates behind his back and head, and further protection is provided by a complete armour-plate bulkhead with sliding door at the after end of the cabin.

The navigator is housed within the flight compartment, with chart table and other aids to efficient navigation. The retractable astral dome is incorporated with an escape hatch in the roof, just aft of the rear end of the coupé. The wireless operator and flight engineer are located aft of the flight compartment.



Details of the construction of the tail surfaces and rear fuselage portion of the Stirling. The very long fuselage is built in sections, bolted together.

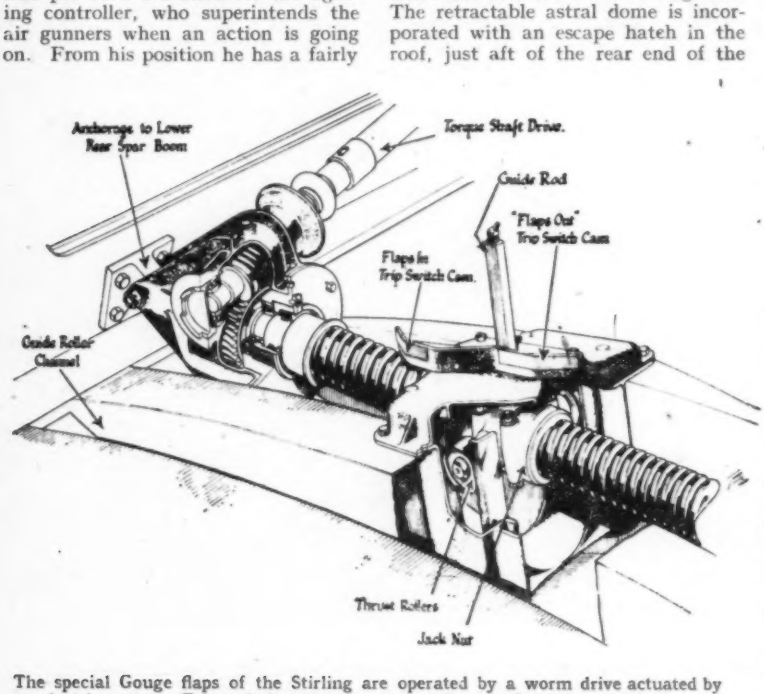
Under the centre-section of the wing, and extending fore and aft, is the bomb cell. No mention may be made of the actual composition of the bomb load, except that it may total as much as 8 tons. An idea of the load is obtained when it is pointed out that the length of the bomb cell is 42ft. 7in., and that it extends right across the floor of the fuselage, being divided by two longitudinal girders into three compartments, each of which houses a series of bombs. The three doors open simultaneously.

The Dorsal Turret

Aft of the centre section of the wing, in the roof of the fuselage, is the dorsal turret, which is a Boulton Paul power-operated one of streamline shape, containing two Browning .303s. From about this position in the fuselage rails run to the four-gun turret in the tail; by these ammunition is sent to the rear gunner. The tail turret is reached by a walkway. All three gun turrets have armour protection.

At the end of the bomb bay are installed the chutes for the parachute flares.

Equipment of the Stirling is, of course, extremely complete, as it must be in an aircraft of this type which has to operate over long distances and in all sorts of weather, sometimes in formation and sometimes alone. Intercommunication telephones connect the members of the crew, but should the system be put out of action by gun fire, there is ample room for a member of the crew to walk from one end of the fuselage to the other with messages. Among the equipment are two



The special Gouge flaps of the Stirling are operated by a worm drive actuated by an electric motor. Trip switches stop the motor when the flap is in the "fully out" and "fully in" positions.

THE SHORT STIRLING

inflatable dinghies, one carried in the fuselage and the other in the wing. The wing dinghy is inflated automatically when the aircraft touches the sea. The Breeze system of wiring by sections is employed.

Behind the dorsal gun turret is an interesting piece of equipment designed to prevent the gunner from hitting his own tail in the excitement of an air engagement. The device bears the intriguing title "taboo track."

Comfort of the crew has been well looked after in the Stirling, and heat is provided by a Gallay boiler heated by the engine exhaust.

Most of the internal equipment, and a good deal of the primary structure, is shown in the drawing by Mr. Max Millar on pp. 98-99. One feature which has characterised Short flying boats from the Empire type onwards, and which is even more pronounced in the Stirling, is the placing of the outer engines very far towards the wing tips, and the amount of equipment, etc., carried inside the wings. It is almost literally true to say that every cubic inch of space has been utilised. If the wing loading were to be further increased, as many advocate in connection with assisted take-off, it is difficult to see where the equipment could be housed.

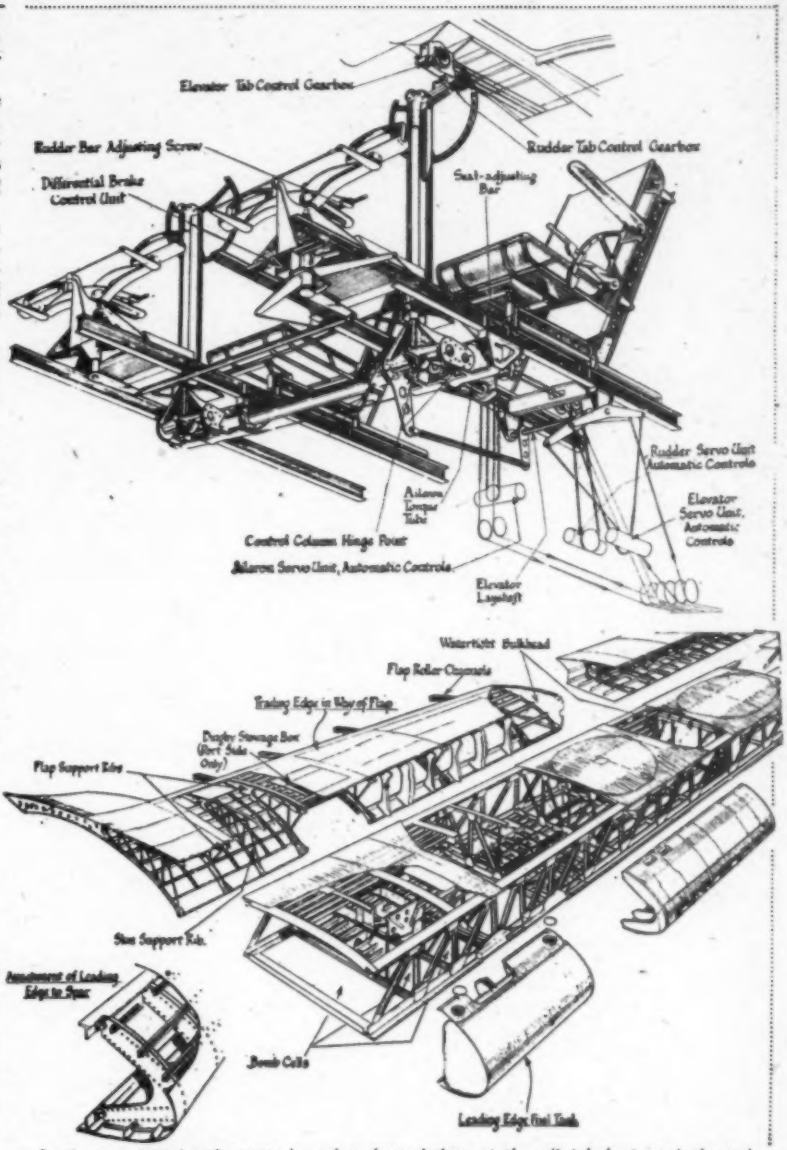
Some Stirling Data

A few figures will help to convey some idea of the impressive size of the Stirling bomber. The wing span is 99ft. 1in. and the gross wing area 1,460 sq. ft. Using the span: area formula, this gives an aspect ratio of just over 6.5, which must be regarded as low for a machine of this class, but, as already explained, the span was limited in the specification to which the Stirling was built.

The overall length is 87ft. 3in., and the inside dimensions of the fuselage are 8ft. 8in. in height and 6ft. 8in. in width.

When fully loaded the Stirling weighs over 30 tons (68,000 lb.), so that the wing loading is in the neighbourhood of 47 lb./sq. ft. In spite of this, the machine is extremely manœuvrable. The maximum speed is approximately 300 m.p.h., the maximum bomb load is 8 tons (18,000 lb.), and the maximum range is 2,000 miles.

Having been in service since 1940, the Stirling has proved its worth on many occasions, and not only has it carried its heavy bomb loads to enemy targets, but it has given good accounts of itself in many aerial encounters. So, once more, the Air Ministry's faith in Short Brothers has been fully justified, and the nation may be proud of the men who produced the machine, among whom but



In the top right-hand corner is a view from below of the pilots' dual controls and portions of the automatic pilot equipment. The other sketch shows details of the wing construction of the Stirling, and the system of dividing it into units.

a few can be mentioned of the hundreds who contributed to the design. Mr. Oswald Short deserves credit for having picked the team, Mr. Gouge for his inspiring work as general manager and deputy chairman of the company; Mr. Lipscomb as chief designer, and Mr. Lankester Parker as chief test pilot. For the benefit of the newer readers of *Flight* it might be explained that Mr. Gouge's contribution has actually been far greater than might be thought merely from his official position in the company. He has worked in every department of the Short works, and for many years he was chief designer, so that one may assume that he had, in addition to his other duties, much to do with the actual design in collaboration with Mr. Lipscomb.

In addition to the parent company, a word of praise should be addressed to the different dispersal factories and the extremely numerous sub-contracting firms, all of which have contributed so much to the translation of the designs and drawings into a powerful striking force.

Women labour is extensively employed in Stirling bomber factories, where work on light aluminium alloys is clean and appealing to that big army of patriotic women performing national service. There is room for many more!

Service Aviation

ROME-BERLIN EXPRESS: Right from the commencement of hostilities the Merlin Whitley has done yeoman service with the Bomber Command.

Royal Air Force and Fleet Air Arm News and Announcements

Awards

Fleet Air Arm

For courage, enterprise and resolution in air attacks upon the enemy:—

DISTINGUISHED SERVICE ORDER.

Lt. (A) C. B. LAMB, D.S.C., R.N.; Temp. L. (A) R. E. BIBBY, R.N.V.R.

DISTINGUISHED SERVICE CROSS.

Lt. (A) F. C. NOTTINGHAM, R.N.V.R.; Sub.-Lt. (A) M. P. GORDON SMITH, R.N.; Temp. Act. Sub.-Lt. (A) G. L. DAVIES, R.N.V.R.; Temp. Act. Sub.-Lt. (A) J. M. ROBERTSON, R.N.V.R.

For bravery in saving a fellow officer from a burning aircraft:—

M.B.E.

Temp. Act. Sub-Lt. (A) D. A. MARCHANT, R.N.V.R.

THE KING has been graciously pleased to approve the following awards in recognition of gallantry displayed in flying operations against the enemy:—

DISTINGUISHED FLYING CROSS.

Act. Flt. Lt. W. N. CREBBIN, R.A.F.V.R., No. 7 Squadron.—This officer, as captain of aircraft, has successfully carried out numerous operational sorties, including attacks on enemy shipping. He has always displayed the greatest determination in pressing home his attack whatever the conditions. Although his aircraft has sustained damage on several occasions, Flt. Lt. Crebbin has displayed fine airmanship and unflinching courage, which have enabled him to fly his aircraft safely back to this country. He has set an excellent example to all.

P/O. G. H. W. GLENN and P/O. D. O. MILLER, both of No. 144 Squadron.—In December, 1941, P/Os. Glenn and Miller were the pilot and navigator respectively of one of a force of aircraft which was detailed to carry out a low level daylight attack on the battle cruiser *Gneisenau* at Brest. Skilful navigation by P/O. Miller enabled the aircraft to break cloud cover over the target area, but, in the run up to attack, an extremely fierce and accurate barrage was encountered, and the aircraft was repeatedly hit by shell-fire.

When nearing the objective, the starboard wing of the aircraft touched the cable of a balloon, which was obscured by the clouds, causing the aircraft to swerve violently. P/O. Glenn regained control and headed for the objective. Almost immediately a shell burst on the tail-plane, inflicting such damage that the aircraft became almost uncontrollable.

In harassing conditions, P/O. Glenn succeeded in flying the aircraft back to an airdrome in this country, where a safe landing was made. Throughout, P/Os. Glenn and Miller displayed rare courage, skill and tenacity. Both officers have carried out repeated attacks against most strongly defended enemy targets.

DISTINGUISHED FLYING MEDAL.

Sgt. C. CUTTING, No. 272 Squadron.—In December, 1941, this airman was the observer of an aircraft which participated in a low level attack on enemy ground forces in Libya. Just before the attack ended, his pilot was wounded in the foot.

During the return journey the wounded pilot twice fainted through loss of blood, but Sgt. Cutting took over the controls and revived his pilot on both occasions, eventually navigating the aircraft a distance of 300 miles to a landing ground, where the pilot effected a landing. By his enterprise and coolness Sgt. Cutting was undoubtedly responsible for the safe return of the aircraft and its crew.

Sgt. G. EASTWOOD, No. 150 Squadron.—One night in December, 1941, this airman was the captain of an aircraft detailed to attack Dusseldorf. Despite fierce anti-aircraft fire and searchlight opposition, Sgt. Eastwood pressed home his bombing attack with great determination, and then, skilfully manœuvring his aircraft, he enabled his rear gunner to deliver effective machine gun fire on searchlight positions from a low altitude. Shortly afterwards Sgt. Eastwood's aircraft was attacked by an enemy fighter whose fire, coupled with opposition from the ground defences, badly damaged his aircraft and killed the second pilot. Nevertheless, Sgt. Eastwood finally avoided further attacks and flew his damaged aircraft back to this country, where he made a successful landing without the use of the hydraulic system. By his courage and resource, Sgt. Eastwood was undoubtedly mainly responsible for the safe return of the aircraft.

Sgt. P. A. C. MCDERMOTT and Sgt. J. S. BOUCHER, both of No. 144 Squadron.—In December, 1941, Sgts. McDermott and Boucher were captain and navigator respectively of one of a force of aircraft which attacked the battle cruisers at Brest in daylight. Whilst over the target area, intense and accurate defensive fire was encountered, and the aircraft, being repeatedly hit, sustained much damage. Despite this Sgts. McDermott and Boucher pressed home their attack and bombed the target from 1,000 feet. The explosion from an enemy shell stunned Sgt. Boucher, who was wounded in the face and eyes by flying fragments. Sgt. Miller skilfully piloted his aircraft from the fire zone, and, assisted by his wounded navigator, who, although suffering intense pain, insisted on directing his pilot, eventually flew back to an airdrome in this country, where a safe landing was effected. Both these airmen displayed skill and fortitude throughout. Some few days earlier, Sgts. McDermott and Boucher successfully carried out a difficult mine-laying mission in enemy waters.

THE KING has been graciously pleased to approve the following awards:—

GEORGE MEDAL.

Sgt. T. B. MILLER, R.C.A.F.—One night in September, 1941, Sgt. Miller was the air observer of an aircraft which, following a successful attack on a target in North West Germany, had been attacked by an enemy fighter. The controls were damaged, and the starboard engine was put out of action, and the pilot had to effect a forced landing. The aircraft landed heavily with undercarriage retracted, came to rest half over a hedge, and caught fire.

The rear gunner and second wireless operator were only slightly injured and escaped from the rear of the aircraft. Sgt. Miller was also uninjured and escaped through the top hatch. He then noticed that the pilot and first wireless

Vice Admiral E. E. L. Helfrich, commander of the Dutch Air Force in the Indies.

operator were still in the aircraft, which was now blazing furiously.

Undeterred, Sgt. Miller re-entered the aircraft through the top hatch and found the captain lying in a dazed condition, as he had been wounded about the face and head. Sgt. Miller pulled the captain through the hatch and carried him away from the aircraft. He returned for the first wireless operator, who was lying in the rear of the cabin, very badly hurt and with his clothing on fire in one or two places.

Sgt. Miller succeeded in lifting him through the hatch and carried him to a place of safety, where he beat out the flames from the injured man's clothing with his hands, after rolling him on the ground in an attempt to smother them.

The flares, oxygen bottles, ammunition and petrol tanks began to explode immediately after Sgt. Miller got clear of the aircraft. He received severe burns to his hands while rescuing his comrades, whose lives were undoubtedly saved by his prompt and extremely brave action.

BRITISH EMPIRE MEDAL (MILITARY DIVISION).

Sgt. J. W. EMMETT.—In the early hours of a day in September, 1941, this airman saw an aircraft having difficulty in landing at an airdrome. Anticipating a crash he took charge of the fire tender, although not officially on duty, and arrived at the scene of the accident within three minutes. The aircraft, which had been broken in two by the impact, was burning furiously and two members of the crew could be seen alive in the flames below the fuselage.

Sgt. Emmett, protected only by asbestos gloves, dashed into the burning wreckage and extricated one of the crew. Before he could return for the second man, the petrol tank split and the fierce heat of the blazing petrol then prevented any near approach.

Sgt. Emmett tried repeatedly to extricate the other living member of the crew by means of a grab hook but without success. In spite of a violent explosion, Sgt. Emmett continued to direct the work of his fire party until the fire was completely extinguished and the remaining bodies were recovered. Unfortunately the rescued airman has since died of his injuries.

Sgt. Emmett on this occasion displayed great devotion to duty and courage and disregard for his own safety. He has been in charge of the station fire fighting personnel for the past nine months, and has shown considerable fortitude and presence of mind at many flying accidents on and near the station.

Sgt. F. B. MITCHELL.—Sgt. Mitchell was the wireless operator-air gunner of an aircraft which, whilst engaged on a navigation flight, crashed into a hill side in sparsely populated mountain country. The pilot was killed and the remainder of the crew seriously injured. Sgt. Mitchell, though suffering from serious and painful injuries, crawled on his hands and knees for a distance of two to three miles, over treacherous countryside and during thick fog in order to obtain assistance. The time taken was about 3 hours.

As a result of this airman's courage and devotion to duty, the rescue of the other members of the crew was made possible by nightfall. There is no doubt that, but for his action, they would have succumbed to their injuries.

Sgt. J. J. PLUNKETT, R.A.A.F.—In August, 1941, an aircraft crashed into the sea. Many gallant attempts, both collective and individual, were made to rescue the three members of the crew, but conditions were such that all lost their lives, together with eleven of the would-be rescuers.

Among numerous R.A.F. personnel concerned, Sgt. Plunkett has been chosen for recognition as having shown outstanding gallantry. He swam out 300 yards in the raging sea and brought back an unconscious airman whom he attempted, with the help of others, to revive by artificial respiration. Unfortunately the airman died later.

In addition to his efforts at artificial respiration, Sgt. Plunkett succeeded in bringing three other persons to the shore, and these owe their lives to his courage and determination.

Flt. Lt. W. N. Crebbin, who has been awarded the D.F.C. (Citation on page 102.)

Sgt. J. PURCELL.—Sgt. Purcell was the front gunner of an aircraft which, whilst carrying out an attack on Ostend, received a direct hit from heavy anti-aircraft fire. Although an attempt was made to bring the aircraft back to England, it eventually crashed in the sea some ten miles from the coast. On impact, the captain was thrown down into the bomb compartment, but, after being submerged in fifteen feet of water, he eventually escaped, in a semi-drowned condition, through the broken-off tail of the aircraft.

Sgt. Purcell, who was suffering from burns about the face and hands, had helped the captain to climb out from the wreckage and then supported and encouraged him for about half an hour until it was possible to reach the dinghy. In spite of the captain's continual suggestions that Sgt. Purcell should leave him and get to the dinghy himself, the sergeant refused to do so.

There is little doubt that the captain's life was saved as a result of the determination and bravery shown by Sgt. Purcell. He subsequently displayed courage, cheerfulness and powers of endurance during the three days which the crew spent floating in the dinghy.

L.A/C. L. F. HAMSHERE.—One night in September, 1941, an aircraft caught fire in the air and crashed. L.A/C. Hamshere was the first on the scene, and made several attempts to reach the body of the pilot, but was driven back by the intense heat. Ammunition was exploding rapidly, constituting great danger. Nevertheless, L.A/C. Hamshere proceeded to unload the guns and removed the ammunition to a place of safety. His coolness and courage in endeavouring to extricate the pilot and, later, in unloading the guns were of the highest order, more particularly as he, an accounts clerk, has only a very limited knowledge of either aircraft or guns.

L.A/C. J. HAYNES.—In February, 1941, this airman was a passenger in an aircraft which crashed in a rubber plantation in Malaya, and burst into flames. L.A/C. Haynes, who had sustained superficial injuries only, quickly extricated himself from the aircraft, ran round to the front cockpit, which was enveloped in flames, and observed the pilot endeavouring to extricate himself, but apparently prevented from doing so by the framework of the cockpit.

Although the fuselage was burning with great intensity, and the petrol tanks had not then exploded, L.A/C. Haynes immediately attempted to rescue the trapped pilot. He tried to lift the framework, but found it too hot to handle. By using the branch of a tree, however, he succeeded in pushing away the cockpit framework and was thus able to assist the pilot and drag him to safety.

L.A/C. Haynes, who received severe burns to his hands and arms, displayed great bravery, determination, and a complete disregard for his own safety in his efforts. Unfortunately the pilot has since succumbed to his injuries.

A/C.2 E. C. UMPELBY.—In August, 1941, a fully loaded aircraft was taking off when it crashed and immediately burst into flames near the airdrome boundary. A/C. Umpelby and two soldiers who were near the scene immediately endeavoured to extricate the occupants, all of whom had been killed instantaneously.

The aircraft was burning fiercely, but A/C. Umpelby and the two soldiers continued their efforts at great risk until compelled to desist by the intense heat. Although his endeavours proved unavailing, this airman showed great courage and a complete disregard of the fact that the petrol tanks might have exploded at any time.

Roll of Honour

Air Ministry Casualty Communique No. 104.

THE Air Ministry regret to announce the following casualties on various dates. The next-of-kin have been informed.

Royal Air Force

KILLED IN ACTION (WHILE FLYING IN OPERATIONS AGAINST THE ENEMY).—A/C.1 A. E. Bennett; Sgt. P. W. Bilsborough; Sgt. N. E. Cooke; Sgt. D. Cross, D.F.M.; L.A/C. A. Doncaster; Sgt. R. Enticknap; Sgt. S. J. Epps; Sgt. E. P. Greenhow; Sgt. L. Wishart.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Sgt. J. Bradshaw; Sgt. W. V. Fillingham; Sgt. J. E. Gittins; Sgt. R. P. Mayers; P/O. J. F. T. Ogilvie.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—P/O. G. B. S. Agar; Flt. Sgt. C. W. Andrews; Sgt. J. G. Armstrong; Sgt. V. E. Ashworth; Flt. Lt. G. O. L. Bird, D.F.C.; Sgt. C. A. E. Birtles; P/O. C. E. Blair; P/O. W. A. Brown; Sgt. R. W. Channer; F/O. F. G. Collins; Sgt. L. D. Coogan; Sgt. J. Golding; P/O. P. B. Gough; Sgt. H. K. Hall; Sgt. H. Hannay; Sgt. W. P. Hannigan; F/O. P. S. Hirst; Sgt. C. G. Humble; Sgt. K. J. Hutt; Sgt. A. Jordan; Flt. Lt. G. O. Lloyd, D.F.C.; Sgt. L. Manchip; Flt. Sgt. C. I. Martin; P/O. J. T. Monks; Sgt. H. A. Morris; Sgt. P. N. Nutt; P/O. I. Ormiston; Sqn. Ldr. M. T. St. J. Pattle, D.F.C. and Bar; Sgt. E. R. Payton; Sgt. S. G. Peplar; Sgt. J. G. Proctor; Sgt. R. G. Pyatt; Sgt. E. J. J. Raper; Sgt. C. F. Spouge; Sgt. F. G. Stewart; Sgt. L. C. Turner; Sgt. D. H. Viney; Sgt. D. F. F. Watson; Sgt. M. D. J. Williams.

PREVIOUSLY REPORTED MISSING, NOW REPORTED KILLED IN ACTION.—Sgt. D. C. Ross.

DIED OF WOUNDS OR INJURIES RECEIVED IN ACTION.—Flt. Lt. A. S. E. Scarf.

MISSING, BELIEVED KILLED IN ACTION.—Sgt.

Tank and bomber crews recently exchanged visits to each other's stations. In these photographs they are seen making the acquaintance of the other fellow's weapon.

SERVICE

M. W. G. Fox; Sgt. E. W. Jackson; L.A/C. F. W. Lea; P/O. E. G. Marker; L.A/C. A. P. Walker.

MISSING.—Sgt. R. K. Anson; Sgt. J. D. Ashcroft; Sgt. W. L. Ball; Sgt. G. Barnes; Sgt. K. W. Barnfield; Sgt. J. Blunt; Sgt. R. H. Breckell; Sgt. P. Buckby; Sgt. L. J. Burcher; Sgt. F. K. Calcutt; F/O. J. A. Caldwell; L.A/C. S. V. Clench; P/O. E. D. Comber-Higgs; Sgt. W. W. Clover; Sgt. R. Crawley; P/O D. J. W. Cruickshank; Sgt. G. C. Davies; Sgt. A. Dean; Sgt. R. O. Dowling; Sgt. J. O. Edmonds; F/O. S. G. H. Fawkes; L.A/C. N. J. Ficken; Sgt. R J. Fido; Sgt. F. Fishwick; Sgt. M. A. Forrest; Sgt. A. J. Freeman; Sgt. A. H. Gee; Sgt. J. Goodbrand; Sgt. P. A. Goodley; Sgt. T. F. Gowan; Sgt. E. J. F. Grant; Sgt. H. Griffiths; P/O. F. D. Hammersley; Sgt. E. A. Harry; F/O. J. B. Hatchwell; Sgt. A. E. Hill; Sgt. R. E. Hirons; Sgt. F. C. Hubbard; Sgt. G. P. Hughes; Sgt. J. B. Hughes; Sgt. J. E. Hughes; Sgt. G. S. Illingworth; Sgt. D. D. Jones; Sgt. D. S. Kay; Sgt. R. G. Kidby; Sgt. J. H. Killick; P/O. H. Knight; P/O. J. S. Knowles; Sgt. D. McCready; Sgt. H. B. McGarrow; Sgt. L. G. Manning; Sgt. T. H. Marlow; Sgt. B. D. Meagher; Sgt. A. J. Moore; Sgt. W. J. Moss; Sgt. G. S. H. Mott; Sgt. R. E. Nicholson; Sgt. E. H. J. Painter; P/O. A. R. Porter; Sgt. F. E. Rolfe; Sgt. W. D. Rowbotham; Sgt. N. F. Sewell; Sgt. A. C. Shorey; Sgt. D. Sidebottom; Sgt. D. Sizmur; F/O. D. A. Smith; Sgt. J. F. Tarran; A/C.1 N. W. Thomas; Sgt. V. E. Towers; Sgt. R. Turner; Sgt. A. F. Wales; Sgt. J. H. Walker; Sgt. E. Waller; Sgt. W. Webster; Sgt. A. Whewell; P/O. T. McS. Wilson; F/O. A. R. Zatonski.

MISSING, BELIEVED KILLED ON ACTIVE SERVICE (WHILE ENGAGED ON NON-OPERATIONAL FLYING DUTIES OR ON THE GROUND THROUGH ENEMY ACTION).—P/O. A. G. Murray-Smith; Flt. Lt. T. G. Pace; P/O. R. G. Prior.

KILLED ON ACTIVE SERVICE.—P/O. J. E. Allen; Sgt. R. Barr; P/O. B. B. H. Best; Sgt. C. Cocks; F/O. H. W. Cottam; F/O. L. R. Darwen; Sgt. W. Dann; Act. Sgt. I. L. Falconer; Sgt. J. Few; Sgt. T. R. Griffiths; Sgt. H. R. Grindrod; L.A/C. A. C. Hearn; P/O. H. T. Hill; Sgt. F. Holt; Sgt. R. Keyworth; Sgt. H. J. Lewis; L.A/C. E. McAllister; Sgt. D. MacM. Macalpine; Sgt. F. E. Martin; L.A/C. J. E. Mayo; Sgt. J. Newton; L.A/C. J. H. Ryalls; L.A/C. F. E. Salmon; Sgt. G. C. Shores; Flt. Sgt. A. C. Smith; Sgt. A. W. Steadman; Sgt. W. G. Taylor; P/O. R. M. Thomas.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED ON ACTIVE SERVICE.—Cpl. E. Astley; A/C.2 J. R. Avery; Cpl. W. G. Aveson; L.A/C. A. J. Ballinger; A/C.2 W. H. Beament; A/C.2 T. B. Black; Cpl. J. Brown; A/C.2 R. O. Brown; A/C.2 P. H. F. Cane; A/C.2 A. G. Carr; A/C.1 A. M. Cheesman; Sgt. B. F. Clare; A/C.2 L. W. Claydon; Sgt. G. A. Cole; A/C.1 M. Collingwood; L.A/C. M. F. Craggs; Cpl. W. G. Cudworth; A/C.2 R. E. Davies; A/C.1 H. J. Deakin; A/C.2 R. Dearnley; L.A/C. R. S. Deighton; Cpl. W. P. Denson; A/C.1 J. C. Forsyth; A/C.1 R. S. Fry; A/C.2 R. Gilholm; A/C.1 R. H. Girvan; Sgt. D. K. Glass; L.A/C. L. E. Grant; A/C.1 J. W. Hall; A/C.1 C. Hams; L.A/C. W. T. Hayward; A/C.1 J. Herk; A/C.1 G. N. Higham; L.A/C. C. Hobbs; Sgt. L. S. Liddiard; Sgt. H. W. G. Norman-Arterton.

WOUNDED OR INJURED ON ACTIVE SERVICE.—L.A/C. A. F. Barrett; Sct. J. H. A. Cox.

DIED OF WOUNDS OR INJURIES RECEIVED ON ACTIVE SERVICE.—Sgt. M. Thompson.

DIED ON ACTIVE SERVICE.—A/C.2 G. F. Hare; A/C.1 P. P. S. Howick; P/O. C. J. Murray; A/C.1 R. J. Ogburn; A/C.2 F. W. Poyner.

Women's Auxiliary Air Force

DIED ON ACTIVE SERVICE.—A/CW.2 E. C. Birch.

Royal Australian Air Force

KILLED IN ACTION.—Sgt. G. W. Hutton.

WOUNDED OR INJURED IN ACTION.—P/O. A. P. Stephenson.

MISSING.—Sgt. E. G. Enright; F/O. B. A. Evans; P/O. W. K. Hayne; P/O. D. S. Jefferies; Sgt R. Johnston; Sgt. R. A. Knappett; P/O. T. K. Robinson; P/O. A. G. Sands; Sgt. J. Shannon.

MISSING, BELIEVED KILLED ON ACTIVE SERVICE.—Sgt. R. E. Barklay.

KILLED ON ACTIVE SERVICE.—P/O. O. K. Fisher; Sgt. E. C. Hutton; Sgt. H. A. Metcalfe; Sgt. K. F. Thornton.

WOUNDED OR INJURED ON ACTIVE SERVICE.—Sgt. A. N. Bingley.

Royal Canadian Air Force

KILLED IN ACTION.—Sgt. G. G. Armstrong.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Sgt. D. McL. Duffy; Sgt. T. H. Park.

MISSING.—P/O. J. R. Coleman; Sgt. G. M. Drennan; Sgt. J. D. Drennan; P/O O. B. Hughes; Sgt. S. L. Innes; Sgt. W. A. Keogh; Sgt. A. H. Lawrence; Sgt. R. L. J. Lizotte; Sgt. E. A. Lowther; Sgt. H. E. Marshall; P/O. E. M. D. Romilly; Sgt. S. T. C. Thompson; P/O. A. Williams; Sgt. H. I. Wolf.

KILLED ON ACTIVE SERVICE.—Sgt. J. A. Brown; Sgt. V. D. B. Martin; Sgt. G. H. Schrader; P/O. C. H. Woodworth.

WOUNDED OR INJURED ON ACTIVE SERVICE.—P/O R. W. Shepherd.

Flt. Sgt. Charlton Haw, who has been awarded the D.F.M. He has been on operational flying since June, 1940.

DIED OF WOUNDS OR INJURIES RECEIVED ON ACTIVE SERVICE.—Sgt. A. D. W. Cuthbert.

DIED ON ACTIVE SERVICE.—Sgt. R. MacL. Cann.

Royal New Zealand Air Force

KILLED IN ACTION.—P/O. J. D. McVay.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Sgt. C. K. McKenzie.

MISSING, BELIEVED KILLED IN ACTION.—P/O W. S. Emmett.

MISSING.—Sgt. F. C. Harrison-Smith; P/O. R. S. Masters; P/O. B. M. Murdock; P/O. M. K. Nelson; Sgt. A. J. W. Parker.

KILLED ON ACTIVE SERVICE.—P/O. L. K. Duncan; P/O. J. A. Grierson; Sgt. H. L. Saundercock; Sgt. D. A. Wither.

South African Air Force

MISSING, BELIEVED KILLED IN ACTION.—2/Lt. J. F. R. Dobson.

MISSING.—2/Lt. C. B. Willson.

Casualty Communique No. 105.

THE Air Ministry regret to announce the following casualties on various dates. The next-of-kin have been informed.

Royal Air Force

KILLED IN ACTION (WHILE FLYING IN OPERATIONS AGAINST THE ENEMY).—Sgt. H. A. Berry; Sgt. R. E. L. Bowerman; F/O. C. A. P. Christie; Sgt. C. L. A. Collins; Flt. Lt. J. G. Fletcher, A.F.C.; Sgt. A. E. Howland; Sgt. G. Hunniford; Act. Flt. Lt. E. A. Jewiss, D.F.C.; Sgt. C. Love; Flt. Sgt. J. C. Millar; Flt. Sgt. S. W. Morris; P/O. W. C. B. Parker; Sgt. J. P. Ranger; Sgt. D. C. M. Ross; Act. Sqn. Ldr. G. F. Witney.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Sgt. K. P. Campbell; Sgt. N. C. Cook; Sgt. A. Cooke; Sgt. F. S. Ellis; Sgt. J. T. Farmer; Sgt. F. Fullard; Flt. Lt. G. F. Gregory; Sgt. D. Gunn; Sgt. E. B. Inman; P/O. F. A. Letchford; Sgt. G. Lickley; Sgt. W. T. McDonald; Sgt. J. Mathews; Flt. Sgt. C. T. C. Mercer; Sgt. L. R. Mynott; Sgt. R. Palmer; Sgt. J. R. Park; Flt. Sgt. P. Tweedale; Sgt. A. Yoxall.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Sgt. E. E. Allnatt; Sgt. A. J. Anthony; P/O. E. H. Atkins; Sgt. E. G. Baker; Sgt. J. E. S. Bevan; Sgt. M. D. Brooker; Sgt. P. Brown; Sgt. J. H. Bruce; Act. Wing Cdr. K. O. Burt, D.F.C.; Sgt. H. F. Bywaters; Sgt. S. G. Capel; Sgt. D. Chappell; Cpl. R. S. Clark; Sgt. T. C. C. Clifton; Sgt. H. Currie; A/C.1 E. B. Doherty; Sgt. G. M. Duffus; Flt. Sgt. C. E. A. Dunlop, D.F.M.; P/O. T. G. Edwards; P/O. C. H. Farvis; Sgt. C. R. Glover; P/O. B. A. Godsmark; Sgt. I. F. Gow; Sgt. J. E. Hodges; Flt. Sgt. G. V. Hoyle; Sgt. J. Hughes; Sgt. C. Jennings; Flt. Sgt. D. G. Keane; P/O. G. H. Kidd; Sgt. A. Kossick; Sgt. W. B. Longstaff; Flt. Lt. J. J. Lowe; Sgt. W. W. MacLeod; Sgt. E. D. Maddison; Sgt. R. K. Main; P/O. P. Montague-Bates; Sgt. A. J. Morgan; Flt. Sgt. E. M. Mulligan; Sgt. H. Murphy; Sgt. K. Noddle; Sgt. A. H. Norris; Sgt. C. P. O'Dell; Flt. Lt. G. T. Palmer, D.F.C.; Sgt. R. C. Plaistowe; Sgt. J. Peel; P/O. K. E. Platt; Sgt. G. W. Richards; Act. F/O. F. G. Roberts; Sgt. R. B. Scott; P/O. R. M. Slade; Sgt. E. F. J. Snutch; Sgt. A. J. Somerville-Woodiwis; Sgt. D. P. Stickland; Flt. Sgt. R. G. St. James-Smith; Sgt. D. M. Syme; P/O. E. W. Thomas; Sgt. O. B. Thompson; P/O. C. Tyler; P/O. P. J. Vincent; Sgt. H. S. Walters; Sgt. A. D. Whitson; Sgt. D. P. Williams; P/O. M. F. Williams; Flt. Sgt. P. Williams; Flt. Sgt. J. P. Wilson; Sgt. I. R. Wilson; Sgt. F. Wood; Sgt. J. Wood.

AVIATION

WOUNDED OR INJURED IN ACTION.—Sgt. J. C. A. Bell; P/O. G. N. Halliday; Sgt. F. M. Hollies; P/O. J. C. R. Hooper; Sgt. D. W. M. Rogerson; Sgt. J. S. Ross; Sgt. P. J. Rudge; Sgt. H. H. Standen.

MISSING, BELIEVED KILLED IN ACTION.—Sgt. W. B. Allan; P/O. J. A. Barclay; Sgt. J. Butterworth; Sgt. F. F. De Smidt; Sgt. J. S. Gearing; Sgt. A. Gilmour; Sgt. H. Greenwood; Sgt. H. B. Lee; Sgt. W. J. Lewis; Sgt. J. H. Lucking; Sgt. R. T. Morris; Sgt. S. Napier; Flt. Sgt. H. H. Penrose; Sgt. R. T. Quilter; F/O. J. M. H. Sargent; Sgt. J. S. Saunders; Flt. Sgt. F. Sumner; Sgt. J. H. L. Thompson.

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MISSING, BELIEVED KILLED ON ACTIVE SERVICE (WHILE ENGAGED ON NON-OPERATIONAL FLYING DUTIES ON THE GROUND THROUGH ENEMY ACTION).—Sgt. D. Brooksbank; Sgt. C. Martin; Sgt. K. W. Squirrell.

KILLED ON ACTIVE SERVICE.—L.A/C. R. K. Agnew; A/C.2 L. A. Arnold; Sgt. A. F. Bulgin; A/C.2 T. C. R. Clemo; P/O. J. C. Cooke; P/O. P. A. Dale; L.A/C. E. J. Dyce; Flt. Lt. A. L. Edy, D.F.C.; P/O. G. D. Fudge; L.A/C. E. A. Griffin; Sgt. D. W. C. Groves; P/O. S. G. A. Hamburger; A/C.2 F. G. Hassall; Sgt. W. N. Hattemore; Cpl. J. G. Hetherington; A/C.2 F. D. Hill; Sgt. A. W. Jack; A/C.2 J. Kempson; L.A/C. H. J. McCarthy; Wing Cdr. L. J. Neale; A/C.2 S. H. Noakes; P/O. T. R. Powell; Sgt. N. Scott; A/C.2 R. Spry; Sgt. F. W. Thurget; A/C.2 F. W. Walton; P/O. A. P. Webb; Flt. Lt. A. A. P. Weller, D.F.C.; L.A/C. W. M. Wilson; A/C.2 L. W. Yea.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED ON ACTIVE SERVICE, NOW PRESUMED KILLED ON ACTIVE SERVICE.—Sgt. G. C. Allenby; Sgt. W. L. Brown; Sgt. C. G. Evans; Flt Sgt. L. H. Wrightson.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED ON ACTIVE SERVICE.—Sgt. K. W. Clifton; A/C.2 P. A. Costello; Sgt. P. Cramp; A/C.1 E. French; A/C.2 A. Fullarton; L.A/C. A. H. Hendrie; Sgt. H. L. Moody, D.F.M.; Sgt. J. E. Sellors.

WOUNDED OR INJURED ON ACTIVE SERVICE.—A/C.2 L. Clough; P/O. H. M. Friend; Flt. Lt. D. R. M. Frostick; Sgt. J. F. Griffiths; Sgt. E. E. Vergette.

DIED OF WOUNDS OR INJURIES RECEIVED ON ACTIVE SERVICE.—L.A/C. W. F. Barton; Sgt. A. J. Birchwood; L.A/C. R. C. Summerell; Flt. Sgt. J. L. F. Willis.

DIED ON ACTIVE SERVICE.—A/C.2 N. J. Abdee; L.A/C. F. G. Broomhall; A/C.2 B. D. Crisp; A/C.2 D. J. Davies; F/O. W. J. Gardiner; A/C.1 E. E. R. Gornall; A/C.1 J. Hepburn; L.A/C. W. Maguire; A/C.1 E. J. Price; A/C.2 D. K. Pounds; Sgt. C. Travill; A/C.2 C. L. Walls.

Royal Australian Air Force

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Sgt. D. E. G. Denier.

MISSING.—F/O. F. F. H Eggleston; Sgt. J. M. Emery; F/O. D. E. Knight.

Royal Canadian Air Force

KILLED IN ACTION.—Sgt. J. P. Taylor.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Sgt V. B. Quinlan; Sgt. W. B. Smith.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—P/O. T. K. Coupland.

WOUNDED OR INJURED IN ACTION.—P/O. R. H. Cotton.

MISSING, BELIEVED KILLED IN ACTION.—Sgt. D. G. McKay; P/O. F. B. Wellings.

MISSING.—P/O. J. S. Gain; P/O G. C. H. Jackson; F/O. A. W. Troup.

MISSING, BELIEVED KILLED ON ACTIVE SERVICE.—Sgt. T. E. Tressam.

KILLED ON ACTIVE SERVICE.—Sgt. H. L. Hicks; Sgt. M. B. Innes; P/O. J. G. Magee; P/O. J. H. Murchie; Sgt. H. J. Robinson.

WOUNDED OR INJURED ON ACTIVE SERVICE.—P/O. R. H. Pallen

Royal New Zealand Air Force

MISSING.—Sgt. A. H. Gumbley.

KILLED ON ACTIVE SERVICE.—P/O A. G. Wicks

South African Air Force

KILLED IN ACTION.—Lt. G. Genis.

WOUNDED OR INJURED IN ACTION.—Air Sgt. L. E. Venter; Lt. J. R. Verster.

MISSING.—Air Sgt. R. G. Black; Lt. E. Y. Corbett; Lt. B. A. Garden; Air Sgt. G. H. James; Lt. F. C. Lo entz; Lt. A. H. M. Moolman; Lt. L. O. B. Player.

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The Outlook

Grand Strategy

MR. CHURCHILL'S speech on January 27th was a candid review of the whole grand strategy of the war, and yet it had surprisingly little in it about the air. The Prime Minister frankly admitted that because the United States and ourselves had temporarily lost command of the seas in the Pacific, and that command had passed to Japan, the third strongest naval power in the world, she would be able to inflict "very heavy and painful losses" on the United Nations (that expression is to take the place of "Allies") which have possessions there. Yet it was the clever use made of aircraft by the Japanese which altered the naval situation. We know from the report of the American commission that proper precautions were not taken at Pearl Harbour; we have not yet been told why the *Prince of Wales* and *Repulse* did not receive fighter protection (which was within reach) at the time when the Japanese attacked them. But the Prime Minister was obviously right when he pointed out that the dispersion of the Japanese forces on many islands will be a source of weakness to them once the United Nations have regained command of the seas.

Mr. Churchill is as much alive as any man to the importance of air power, and he was able to tell the House that before he left for America on December 12th he had arranged for the despatch of air reinforcements to Malaya and Burma. These have already made themselves felt, and the Japanese losses in aircraft have been mounting. The sight of them has also cheered up the regiments, British, Australian and Indian, who have been fighting so gallantly down the Malay peninsula. What else he has sent he naturally did not tell the House of Commons, but it is not to be supposed that H.M.S. *Duke of York* took the Prime Minister to the United States as a sort of luxury cruise.

Bomb Loads, Speeds and Altitudes

WE have been astounded of late to observe the loose figures that are constantly being quoted about bomb loads and speeds of different aircraft in the American journals—always with the idea of showing the superiority of American products. For instance, in reviewing the features of the Stirling, our usually well-informed contemporary *Aviation* under its "Foreign Flying Equipment" says:—

> "The Stirling, built like a flying box car, must be capable of carrying a bigger bundle of bombs to Berlin, something like 6,000-7,000lb. The Fortress Model C carries about 4,800lb. . . . British pilots (not the magazine writers) are credited with saying that at high altitudes the Boeing was definitely better than the Stirling or Halifax, and that at 25,000 feet they found it to be even faster than the Spitfire or Hurricane."

Our rejoinder to the latter paragraph would be, "Follow the magazine writers!"—although they are often checked by secrecy rules from giving all the facts.

Another curious observation in the same article is the following:—

> "Undoubtedly no Boeings have been lost because they can reach altitudes in excess of effective ground fire, and although ME.109 Fs. have engaged Fortresses in combat at 40,000 feet, the Nazi fighters find it difficult to manœuvre at that altitude."

A few weeks ago an extraordinary effusion by W. L. White in the *Saturday Evening Post* said:—

> "British bomber pilots who do the actual dying have taken the American Flying Fortress up, have seen that they carry on long raids five times the bomb load of the